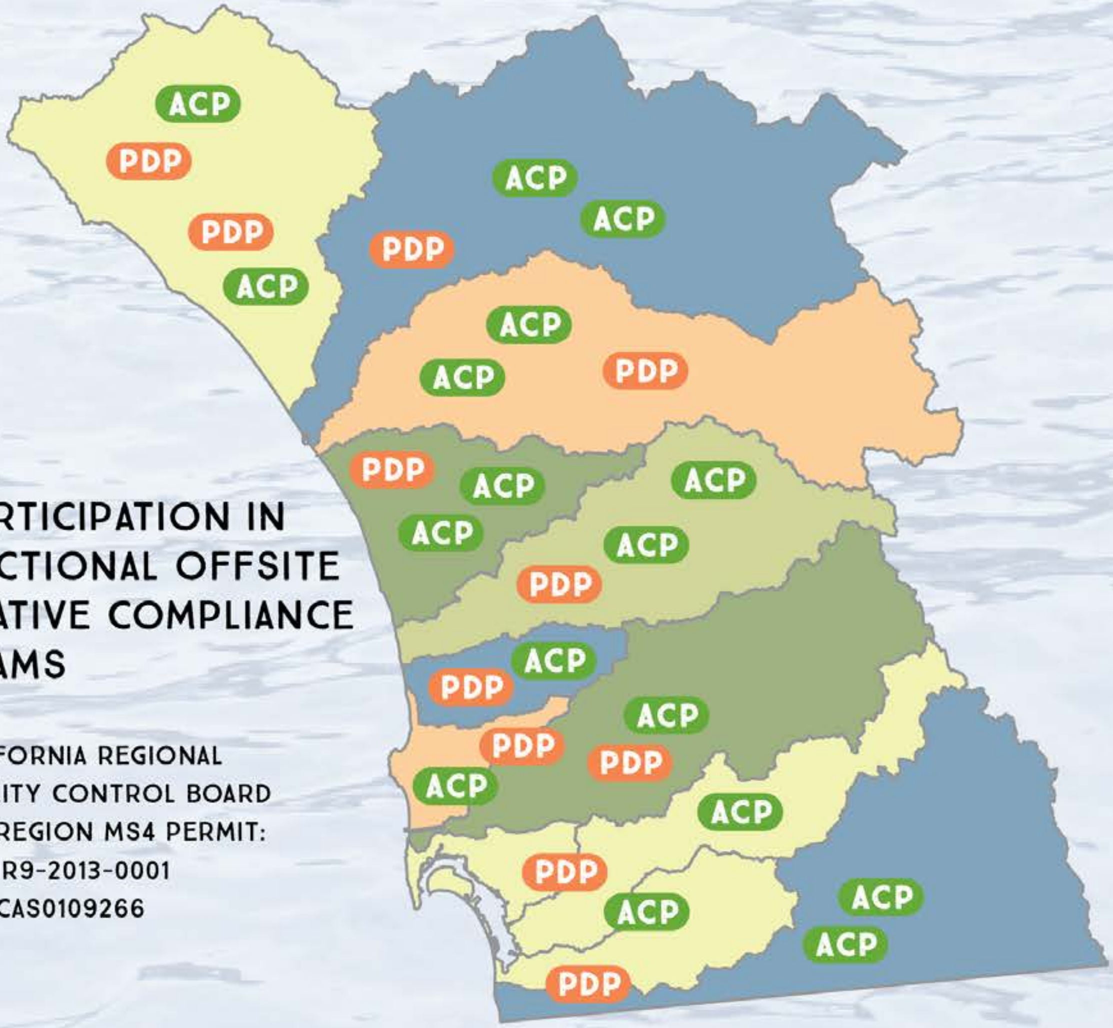
WATER QUALITY EQUIVALENCY

GUIDANCE DOCUMENT

REGION 9



FOR PARTICIPATION IN JURISDICTIONAL OFFSITE ALTERNATIVE COMPLIANCE PROGRAMS

UNDER CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD SAN DIEGO REGION MS4 PERMIT:
ORDER NO. R9-2013-0001
NPDES NO. CAS0109266

DECEMBER 2015

December 17, 2015

Via Email Only

Mr. Jon Van Rhyn
County of San Diego
Watershed Protection Program
5510 Overland Avenue, Suite 410 MS 0-332
San Diego, CA 92123

In reply refer to/attn:
Place ID:786088:ERyan

Subject: Acceptance of the Water Quality Equivalency Guidance Document and Water Quality Equivalency Automated Calculation Worksheets

The California Regional Water Quality Control Board, San Diego Region (San Diego Water Board) reviewed the September 2015 Water Quality Equivalency Guidance Document and Automated Calculation Worksheets (WQE Guidance Documents). WQE Guidance Documents were developed through a combined effort by the San Diego, Orange, and Riverside County Copermittees (San Diego Regional Copermittees), interested stakeholders, and members of the public. The County of San Diego submitted the WQE Guidance Documents on behalf of the San Diego Regional Copermittees, pursuant to Provision E.3.c.(3)(a) of Order No. R9-2013-0001(Order).[1]

The WQE Guidance Documents form the regional and technical basis to calculate and determine the water quality benefits associated with development projects implemented as part of an alternative compliance program established in the Order. San Diego Water Board Executive Officer acceptance of a method to calculate water quality equivalency is required before a Copermittee can implement an alternative compliance program.

An alternative compliance program allows priority development projects that are required to include numerically-sized structural pollutant control and hydromodification management best management practices (BMPs) onsite to implement all or part of the structural BMPs offsite. A priority development project can participate in an alternative compliance program if it is offered by the local jurisdiction and if the proposed offsite project provides a greater water quality benefit to the watershed than implementing the structural BMPs onsite.

The San Diego Water Board accepts the WQE Guidance Documents. Accepted water quality equivalency calculations must be incorporated as part of any Copermittee alternative compliance program to evaluate candidate projects, project applicant-proposed alternative compliance projects, alternative compliance in-lieu fee structures, and alternative compliance water quality credit systems as described in Provisions E.3.c.(3)(b)-(e) of the Order.

[1]Order No. R9-2013-0001 is the National Pollution Discharge Elimination System Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems Draining the Watersheds within the San Diego Region, as amended.

The effective date of the WQE Guidance Documents is the date of this letter and will serve as the single, region-wide, applicable date after which Copermittee-approved alternative compliance projects may begin generating credits for potential future banking, tracking, trading, and selling. Any alternative compliance water quality credit system that a Copermittee chooses to implement must be submitted to the San Diego Water Board Executive Officer for review and acceptance as part of the Water Quality Improvement Plan.

The San Diego Water Board appreciates the Copermittees efforts over the last two years to develop a method for calculating water quality benefits. These calculations will serve as the regional model for those Copermittees who move forward with establishing a jurisdictional alternative compliance program for land development.

In the subject line of any response, please include **PIN:786088:ERyan**. For questions pertaining to the subject matter, please contact Erica Ryan at (619) 521-8051 or Erica.Ryan@waterboards.ca.gov.

Respectfully,

David W. Gibson
Executive Officer
San Diego Regional Water Quality Control Board

DWG:dtb:law:emr

cc: San Diego County Copermittees
Orange County Copermittees
Riverside Copermittees

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TABLE OF CONTENTS

ACRONYMS & SYMBOLS .... **vi**

DEFINITIONS .... **ix**

EXECUTIVE SUMMARY **ES-1**

ES-1. Overall Approach ES-2

ES-2. Types and Categories of Alternative Compliance Projects ES-2

ES-3. Water Quality Equivalency Calculations for Stormwater Pollutant Control ES-5

ES-4. Water Quality Equivalency Calculations for Hydromodification Flow Control ES-8

ES-5. Example Water Quality Equivalency Calculations by Project Type ES-11

1. INTRODUCTION **1**

1.1 Background 1

1.2 Public Process 2

1.3 General Concepts 4

1.4 Use of this Document 8

1.5 General Considerations and Limitations 11

2. WATER QUALITY EQUIVALENCY CALCULATIONS FOR STORMWATER POLLUTANT CONTROL **13**

2.1 Overview of Methodology 13

2.2 Step 1: PDP Stormwater Pollutant Control Impacts 14

2.3 Step 2: ACP Stormwater Pollutant Control Benefits 15

2.3.1 Option A: ACP Stormwater Pollutant Control Benefits for Structural BMPs 17

2.3.1.1 Task 2-1: Design Capture Volume ($V_{1,}$ $V_{2,}$ ΔV) 17

2.3.1.2 Task 2-2: Land Use Factor (L) 18

2.3.1.3 Task 2-3: BMP Efficacy Factor (B) 29

2.3.1.3.1 Task 2-3a: Pollutant Removal Efficiency (E) 31

2.3.1.3.2 Task 2-3b: Provided Capture (C) 32

2.3.1.3.3 Summary of BMP Efficacy Factors 38

2.3.1.3.4 Available BMP Efficacy Factor Tools 44

2.3.1.4 Task 2-4: Earned Stormwater Pollutant Control Volume (V_E) 45

2.3.2 Option B: ACP Stormwater Pollutant Control Benefits for Natural System Management Practices 46

2.3.2.1 Task 2-1: Design Capture Volume ($V_{1,}$ $V_{2,}$ ΔV) 46

2.3.2.2 Task 2-2: Land User Factor (L) 47
2.3.2.3 Task 2-3: BMP Efficacy Factor (B) 48
2.3.2.4 Task 2-4: Earned Stormwater Pollutant Control Volume (V_E) 48
2.4 Step 3: Determination of Stormwater Pollutant Control Credits 48
3. WATER QUALITY EQUIVALENCY CALCULATIONS FOR HYDROMODIFICATION FLOW CONTROL 50
3.1 Overview of Hydromodification Flow Control Equivalency Calculations 51
3.2 Hydromodification Flow Control Equivalency Currency 52
3.2.1 PDP Hydromodification Flow Control Equivalency Currency 53
3.2.2 ACP Hydromodification Flow Control Currency 54
3.3 Location Requirements 54
3.3.1 Determining ACP Location Requirements for a PDP 54
3.3.2 ACP Location Guidelines for Independent ACPs 57
3.4 Design Guidelines for ACPs 57
3.4.1 Sizing an Applicant-Implemented ACP 57
3.4.1.1 New Development or Redevelopment Increasing Impervious Area 57
3.4.1.2 Redevelopment with NO Increase in Impervious Area 58
3.4.2 Sizing an Independent ACP 58
3.5 Calculation of Results for Hydromodification Flow Control Equivalency 58
3.5.1 Applicant-Implemented ACP 59
3.5.1.1 Option A (Mitigate PDP Only) 59
3.5.1.2 Option B (Mitigate More than the PDP Requirement) 59
3.5.2 Independent ACP 60
3.6 Hydromodification Flow Control Equivalency for Stream Rehabilitation 62
3.6.1 Stream Rehabilitation Hydromodification Equivalency Scenario 63
3.6.2 Channel Assessment Process and Stream Rehabilitation Approach 66
3.6.3 Stream Rehabilitation Hydromodification Flow Control Currency 68
4. EXAMPLE WATER QUALITY EQUIVALENCY CALCULATIONS BY PROJECT TYPE 69
4.1 Example 4-1: Retrofit BMPs 69
4.2 Example 4-2: Regional BMPs 78
4.3 Example 4-3: Water Supply BMPs 88

4.4 Example 4-4: Land Restoration NSMPs....................95
4.5 Example 4-5: Land Preservation NSMPs....................99
4.6 Example 4-6: Stream Rehabilitation NSMP Example.................... 103
5. REFERENCES 107

APPENDICES

Appendix A: Water Quality Equivalency Worksheets

Worksheet A.1: Retention BMP Efficacy Factor Determination for WQE

Worksheet A.2: Biofiltration BMP Efficacy Factor Determination for WQE

Worksheet A.3: Partial Retention BMP Efficacy Factor Determination for WQE

Worksheet A.4: Treatment Train BMP Efficacy Factor Determination for WQE

Worksheet A.5: Land Use Factor Determination for WQE

Figure A.1: Provided Capture Curves for Retention BMPs

Figure A.2: BMP Efficacy Factor Planning Tool

Appendix B: WQE Stormwater Pollutant Control Reference Information

B.1: Land Use Factor Supporting Material

B.2: BMP Efficacy Factor Supporting Material

Appendix C: WQE Hydromodification Flow Control Reference Information

C.1: General Hydromodification Reference Information

C.2: Stream Rehabilitation Supporting Material

Appendix D: Relevant WQE Mapping

Exhibit 1: EMC Land Use Mapping

Exhibit 2: Watershed Management Areas and Hydrologic Units

Appendix E: Response to Comments

FIGURES

Figure 1-1: Permit Deliverables Related to Offsite Alternative Compliance Program....................1
Figure 1-2: WQE Process for Stormwater Pollutant Control and Hydromodification Management ..5
Figure 1-3: Stormwater Pollutant Control and Hydromodification Flow Control Process 10
Figure 2-1: WQE Process for Stormwater Pollutant Control....................13
Figure 2-2: PDP Stormwater Pollutant Control Calculations 15
Figure 2-3: ACP Stormwater Pollutant Control Calculations 16
Figure 2-4: Overview of Process for Determining Land Use Factors....................18

Figure 2-5: Watershed Management Area and Hydrologic Unit Map 19
Figure 2-6: Delineation of ACP Tributary Area 21
Figure 2-7: Characterization of ACP Tributary Land Uses 21
Figure 2-8: Reference Tributary by Project Scenario 24
Figure 2-9: Provided Capture Curves for Retention BMPs 34
Figure 2-10: BMP Efficacy Factor Initial Planning Tool 45
Figure 3-1: WQE Process for Hydromodification Flow Control 51
Figure 3-2: Required ACP Location for PDP Increasing Impervious Surface 56
Figure 3-3: Example ACP Location for PDP Not Increasing Impervious Surface 56
Figure 3-4: PDP-Based Stream Rehabilitation 65
Figure 3-5: Watershed-Based Stream Rehabilitation 65
Figure 3-6: Overview of Channel Assessment Process 67

TABLES

Table 1-1: Public Process Outline 3
Table 1-2: ACP Categories Quantified Through Water Quality Equivalency Guidance 12
Table 2-1: WQE Pollutants of Concern by Watershed Management Area and Hydrologic Unit 20
Table 2-2: Relative Pollutant Concentrations and Default Runoff Factors by Land Use 23
Table 2-3: Land Use Composition Values (Acres) for Independent ACP Reference Tributaries 25
Table 2-4: Land Use Factor Determination Spreadsheet 26
Table 2-5: Comparison of BMPDM vs ACP Requirements 33
Table 2-6: Reference Key for Determination of Appropriate BMP Efficacy Factors 38
Table 3-1: ACP Location Requirements by PDP Scenario Type 55

EQUATIONS

Equation 2-1: Calculation of ACP Earned Stormwater Pollutant Control Volume 16
Equation 2-2: Calculation of Weighted Average Relative Pollutant Concentrations 22
Equation 2-3: BMP Efficacy Factor for Retention, Biofiltration, and Flow-Thru BMPs 30
Equation 2-4: BMP Efficacy Factor for Partial Retention BMP 30
Equation 2-5: BMP Efficacy Factor for Treatment Train BMPs 30
Equation 3-1: Determination of Stream Geomorphic Capacity 63

EXAMPLE CALCULATIONS

Example 2-1: Design Capture Volume Calculations (V_1, V_2, ΔV) 18
Example 2-2: Land Use Factor Determination for Applicant-Implemented ACP....27
Example 2-3: Land Use Factor Determination for Independent ACP 28
Example 2-4: Determination of BMP Efficacy Factor for a Retention BMP 39
Example 2-5: Determination of BMP Efficacy Factor for a Biofiltration BMP 40
Example 2-6: Determination of BMP Efficacy Factor for a Partial Retention BMP....40
Example 2-7: Determination of BMP Efficacy Factor for a Flow-Thru BMP 41
Example 2-8: Determination of BMP Efficacy Factor for a Treatment Train BMP 42
Example 2-9: General Application of WQE Formula for Structural BMPs....45
Example 2-10: DCV for Land Preservation Natural System Management Practice 47
Example 2-11: General Application of WQE Formula for NSMPs....48
Example 2-12: Demonstration of Greater Overall Water Quality Benefit 49
Example 3-1: PDP Deficit of Total Impervious Area Effectively Managed....59
Example 3-2: ACP Earned DCIA Effectively Managed - Direct Measurement....61
Example 3-3: ACP Earned DCIA Effectively Managed - Land Use Estimation 62

**Note: See Section 4 for additional examples by project type*

ACRONYMS & SYMBOLS

General Acronyms

ACP: Offsite Alternative Compliance Project

AF: Adjustment Factor

BMP: Best Management Practice

BMPDM: Best Management Practices Design Manual

C: Runoff Factor or Runoff Coefficient

California DF&W: California Department of Fish and Wildlife

CEM: Channel Evolution Model

DCIA: Directly Connected Impervious Area

DCV: Design Capture Volume

EIA: Effective Impervious Area

EMC: Event Mean Concentration

Ep: Erosion Potential

FEMA: Federal Emergency Management Agency

GCU: Geomorphic Channel Unit

HEC RAS: Hydrologic Engineering Centers River Analysis System

HMP: Hydromodification Management Plan

HSPF: Hydrologic Simulation Program Fortran

IBI: Index of Biotic Integrity

ISC: Impervious Surface Coefficient

MS4: Municipal Separate Storm Sewer System

MSCP: Multiple Species Conservation Plan

NRCS: Natural Resources Conservation Service

NSMP: Natural System Management Practice

NPDES: National Pollutant Discharge Elimination System

PDP: Priority Development Project

Q: Flow Rate

RWQCB: Regional Water Quality Control Board

SAG: Stakeholder Advisory Group

SANDAG: San Diego Association of Governments

SANGIS: San Diego Geographic Information Source

SCAG: Southern California Association of Governments

SCCWRP: Southern California Coastal Water Research Project

SWMM: Storm Water Management Model

TAC: Technical Advisory Committee

TAPE: Technology Acceptance Protocol-Ecology

TBD: To Be Determined

TMDL: Total Maximum Daily Load

USACE: United States Army Corps of Engineers

USDF&W: United States Department of Fish and Wildlife

WMA: Watershed Management Area

WMAA: Watershed Management Area Analysis

WQE: Water Quality Equivalency

WQIP: Water Quality Improvement Plan

γ: Specific Weight of Water

Unit Acronyms:

CFS: Cubic Feet per Second

L: Liter

mg: Milligram

ml: Milliliter

μg: Microgram

Pollutant Acronyms:

FC: Fecal Coliform

NH_3: Ammonia

NO_3: Nitrate

TCu: Total Copper

TKN: Total Kjeldahl Nitrogen

TN: Total Nitrogen (NH_3 + NO_3 + TKN)

TP: Total Phosphorus

TPb: Total Lead

TSS: Total Suspended Solids

TZn: Total Zinc

DEFINITIONS

Alternative Compliance Program: See Offsite Alternative Compliance Program.

Alternative Compliance Project: A project implemented to provide a Greater Overall Water Quality Benefit to the Watershed Management Area and offset Stormwater Pollutant Control Impacts and Hydromodification Flow Control Impacts associated with Priority Development Projects (PDPs). Alternative Compliance Projects (ACPs) may be implemented by parties including, but not limited to, agencies, developers, individuals, municipalities, or non-governmental organizations), and may either be Applicant-Implemented ACPs or Independent ACPs.

Applicant-Implemented Alternative Compliance Project: ACPs that are owned or constructed by the same party that is generating a PDP impact. Because both the PDP impacts and the ACP benefits are controlled by the same party in an Applicant-Implemented scenario, there is no need for a Credit System to track and trade associated Water Quality Impacts and Water Quality Benefits.

Biofiltration: Practices that use vegetation and amended soils to detain and treat runoff from impervious areas. Treatment is through filtration, infiltration, adsorption, ion exchange, and biological uptake of pollutants.

BMP Design Manual: Jurisdiction-specific guidance document that sets forth onsite post construction stormwater requirements for standard projects and PDPs, and provides procedures for planning, preliminary design, selection, and design of permanent stormwater best management practices (BMPs) based on the performance standards presented in the Municipal Separate Storm Sewer System (MS4) Permit. Unless otherwise indicated, references to the BMP Design Manual (BMPDM) within this document refer to this jurisdiction-specific guidance document.

BMP Design Manual (Model): Regional-level guidance document that sets forth onsite post construction stormwater requirements for standard projects and PDPs, and provides procedures for planning, preliminary design, selection, and design of permanent stormwater BMPs based on the performance standards presented in the MS4 Permit. The "Model" BMPDM was developed as a regional effort that was completed in June of 2015 and is intended to be used as the basis for jurisdiction-specific BMPDMs (see BMP Design Manual above).

BMP Efficacy Factor: A factor of the WQE formula that quantifies the combined effects of an ACP's Pollutant Removal Efficiency and Provided Capture on the provided stormwater pollutant control benefit.

Channel Form: A stream channel's geometry (in plan, cross-section, and profile) and bed and bank material. Channel form is primarily controlled by discharge and sediment supply (notably bed material), since a stream's primary geomorphic processes are to convey water and sediment.

Copermittee: Any San Diego County, Orange County, or Riverside County Copermittee covered under Order No. R9-2013-0001, NPDES No. CAS0109266.

Credit System: A program that may be implemented by Copermittees to allow for the banking, tracking, trading, and selling of water quality credits and debits between owners or responsible parties. Such a system requires review and acceptance from the RWQCB prior to implementation. Credit systems are not specifically addressed in this guidance document.

Deficit of Total Impervious Area Effectively Managed: The total impervious area for which a PDP does not appropriately address hydromodification flow control requirements from Section E.3.c.(2) of the Permit.

Deficit of Stormwater Pollutant Control Volume: The volume of stormwater for which a PDP does not appropriately address pollutant control requirements from Section E.3.c.(1) of the Permit through onsite retention and/or biofiltration.

Design Capture Volume: The design capture volume (DCV) is the volume of stormwater runoff produced from a 24-hour 85th percentile storm event as determined per guidance set forth in the BMPDM applicable to a jurisdiction.

Directly Connected Impervious Area: The portion of the total impervious area within a tributary that is directly connected to the drainage collection system without dispersion through pervious surfaces. Directly connected impervious areas may include impervious surfaces such as streets, parking lots, driveways, sidewalks, and rooftops.

Earned Directly Connected Impervious Area Effectively Managed: The Directly Connected Impervious Area for which an ACP provides effective hydromodification flow control.

Earned Stormwater Pollutant Control Volume: The volume of stormwater treated by an ACP as augmented by water quality equivalency factors specific only to ACPs. This volume and the associated water quality equivalency factors are calculated per the guidelines set forth in **Section 2.3** of this document and may be used to offset the Deficit of Stormwater Pollutant Control volume from a PDP.

Effectively Treated Stormwater Volume: The volume of stormwater for which pollutant control requirements from Section E.3.c.(1) of the Permit are appropriately addressed through onsite retention and/or biofiltration. Retention-based BMPs must retain (i.e. intercept, store, infiltrate, evaporate, and evapotranspire) onsite the pollutants contained in the design capture volume. Biofiltration-based BMPs must treat 1.5 times the design capture volume not reliably retained onsite, OR treat the design capture volume not reliably retained onsite with a flow-thru design that has total volume, including pore spaces and pre-filter detention volume, sized to hold at least 0.75 times the portion of the design capture volume not reliably retained onsite. This volume is calculated per the guidelines set forth in **Section 2.2** of this document and may be offset by the Earned Stormwater Pollutant Control Volume from an ACP.

Flow-Thru Treatment Control BMPs: Structural, engineered facilities designed to remove pollutants from stormwater runoff using treatment processes that do not incorporate significant biological methods. Flow-thru BMPs may include vegetated swales, media filters, sand filters, proprietary devices, and dry extended detention basins.

Geomorphic Impact: Changes in landforms (i.e., channel forms) and the processes that shape them. Changes to the runoff regime and in-stream processes caused by land use modifications, unless managed, can cause channel erosion, sedimentation, planform migration, changes in bed material composition, as well as ecological impacts to streams. Such impacts may impair beneficial uses and degrade stream conditions.

Geomorphic Stability: State in which a landform (i.e., channel form) is maintained over time within a natural range of variance. True stability never exists in natural streams because they are frequently undergoing channel form adjustments in order to convey a range of discharges and sediment loads. However, fluvial systems can become relatively stable in the sense that, if disturbed, they will tend to return approximately to their previous state and perturbation is dampened. A large scale event, like a flood, forest fire or landslide, can cause dramatic changes in channel form, but the channel will often re-established its equilibrium form over time. However, a persistent alteration to the controls on channel form can cause the channel to begin an evolutionary change in morphology, leading to degradation and instability until it reaches a new equilibrium state.

Greater Overall Water Quality Benefit: A condition in which the quantifiable Water Quality Benefits from (all or part of one or more) ACPs are greater than the quantifiable Water Quality Impacts from (all or part of one or more) PDPs. Benefits and impacts for stormwater pollutant control and hydromodification flow control must be considered individually. Therefore, Greater Overall Water Quality Benefit is demonstrated when Stormwater Pollutant Control Benefits are greater than or equal to Stormwater Pollutant Control Impacts, AND Hydromodification Flow Control Benefits are greater than or equal to Hydromodification Flow Control Impacts.

Hydromodification Flow Control Benefit: The subset of Water Quality Benefits that apply specifically to hydromodification flow control. Hydromodification flow control benefits for ACPs are expressed with a metric of Earned Directly Connected Impervious Area Effectively Managed.

Hydromodification Flow Control Impact: The subset of Water Quality Impacts that apply specifically to hydromodification flow control. Hydromodification flow control impacts for PDPs are expressed with a metric of Deficit of Total Impervious Area Effectively Managed.

Independent Alternative Compliance Project: An ACP that is owned or constructed by a party other than the PDP applicant. Independent ACPs may only be used to mitigate for PDPs within a RWQCB-approved credit system.

In-Lieu-Fee Structure: An optional program that may be implemented by Copermittees individually or with other entities to allow a project proponent to fund or partially fund one or more ACPs in-lieu of fully complying with the on-site pollutant reduction or hydromodification management requirements of Order No. R9-2013-0001. In-lieu fee structures must be sufficient to ensure the proper design, development, construction, operation, and maintenance of ACPs. In-lieu fees must be transferred to the Copermittee (for public projects) or an escrow account (for private projects) prior to the construction of a PDP.

Land Preservation NSMP: An NSM) that permanently preserves undeveloped land in its current state. In limited scenarios, Land Preservation may provide quantifiable stormwater pollutant control and hydromodification flow control benefits by preventing increases in stormwater runoff volumes and pollutant concentrations associated with the future built out condition of a tributary.

Land Restoration NSMP: An NSMP that restores currently developed land back to a stabilized pre-development condition. Land restoration practices are similar to Retrofit BMPs that provide reductions in impervious surfaces, but require appropriate stabilization techniques.

MS4 Permit: See Permit.

Natural System Management Practices: Stormwater management practices implemented to restore and/or preserve predevelopment watershed functions in lieu of providing direct pollutant removal and hydromodification flow control. NSMPs may include structural or engineered elements, but these elements do not expressly provide stormwater pollutant removal. NSMPs include: Land Restoration, Land Preservation, and Stream Rehabilitation projects.

Offsite Alternative Compliance Program: An optional program that may be implemented by individual Copermittees to allow for offsite ACPs to offset stormwater pollutant control and hydromodification impacts that are not fully addressed at PDP sites.

Order No. R9-2013-0001: See Permit.

Permit: California Regional Water Quality Control Board San Diego Region - Order No. R9-2013-0001, as amended by Order Nos. R9-2015-0001 and R9-2015-0100 - NPDES No. CAS0109266 - National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds within the San Diego Region

Pollutant Removal Efficiency: An element of the BMP Efficacy Factor that accounts for the variations in the ability of different BMPs to remove pollutants in runoff delivered to an ACP site.

Priority Development Project: New development and redevelopment projects that propose to create or replace a specific quantity of impervious surface for land uses that are defined under Provision E.3.b of the Permit. PDPs that do not fully satisfy onsite water quality requirements negatively impact the water quality of a Watershed Management Area (WMA).

Provided Capture: An element of the BMP Efficacy Factor that accounts for the portion of BMPDM pollutant control sizing requirements that are satisfied by an ACP. Incorporation of this element in the BMP Efficacy Factor allows for quantification of proportional stormwater pollutant control benefits provided by ACPs that do not fully accommodate the sizing criteria set forth by the BMPDM.

Reference Tributary: The tributary area used to characterize the land use compositions necessary to calculate a Land Use Factor. For Applicant-Implemented ACPs, the reference tributary is the area that drains to a specific PDP. For Independent ACPs, the reference tributary is the specific WMA.

Regional BMP: A stormwater management practice that treats stormwater from more than one development. The primary purpose is to provide one or more of the following benefits to the receiving water: improve water quality, protect downstream channels, reduce flooding, or meet other specific jurisdictional objectives.

Retention BMP: A category of BMP that does not have any service outlets that discharge to surface waters or to a conveyance system that drains to surface waters. Mechanisms used for stormwater retention include infiltration, evapotranspiration, and use of retained water for non-potable or potable purposes.

Retrofit BMP: Adding or modifying structural BMPs on existing sites or in areas of development where the practices do not already exist, are ineffective, or can be significantly enhanced.

Stability Assessment: Evaluation of whether channel form is maintained over time within a natural range of variance. For the purposes of this study, channel stability is assessed qualitatively, using the channel evolution model (CEM) developed by Hawley et al (2012).

Stream Rehabilitation NSMP: Remedial measures or activities for the purpose of improving or restoring the beneficial uses of streams, channels, or river systems. Techniques may vary from in-stream restoration techniques to off-line stormwater management practices installed in the system corridor or upland areas, or a combination of in-stream and out of stream techniques. Rehabilitation techniques may include, but are not limited to the following: riparian zone restoration, constructed wetlands, channel modifications that improve habitat and stability, and daylighting of drainage systems.

Stormwater Pollutant Control Benefit: The subset of Water Quality Benefits that applies specifically to stormwater pollutant control. Pollutant control benefits for ACPs are expressed with a metric of Earned Stormwater Pollutant Control Volume.

Stormwater Pollutant Control Impact: The subset of water quality impacts that applies specifically to stormwater pollutant control. Pollutant control impacts for PDPs are expressed with a metric of Deficit of Stormwater Pollutant Control Volume.

Structural BMP: As defined in the MS4 Permit, structural BMPs are a subset of BMPs which detain, retain, filter, remove, or prevent the release of pollutants to surface waters from development projects in perpetuity, after construction of a project is completed. A structural BMP may be a pollutant control BMP, a hydromodification management BMP, or an integrated pollutant control and hydromodification management BMP.

Susceptibility Assessment: Evaluation of how a channel is likely to respond to hydromodification. This evaluation can focus on whether a stream is vulnerable to channel adjustment (i.e., susceptible or non-susceptible) or the degree to which it is vulnerable in the vertical and lateral directions (e.g., low, medium, high, very high). For the purposes of this document, channel susceptibility is performed using the methods currently employed in the County of San Diego Final Hydromodification Management Plan.

Tributary: A geographical area which drains to a specified point. This may also be referred to as a drainage area, watershed, or catchment.

Water Quality: In the context of this document, water quality strictly refers to the Permit performance standards for both stormwater pollutant control and hydromodification flow control.

Water Quality Benefit: A quantifiable expression of water quality benefits associated with an ACP. Water quality benefits include both Stormwater Pollutant Control Benefits and Hydromodification Flow Control Benefits.

Water Quality Impact: A quantifiable expression of water quality impacts associated with a Priority Development Project. Water quality impacts include both Stormwater Pollutant Control Impacts and Hydromodification Flow Control Impacts.

Water Quality Equivalency: Methodologies and calculations used to determine water quality benefits and water quality impacts, and to apply them toward the design, review, and approval of PDPs and ACPs in meeting the Section E.3.c.(3) (Offsite Alternative Compliance Program) requirements of the Permit.

Water Supply BMP: A BMP that captures stormwater to infiltrate, pump, or otherwise replenish groundwater, surface water, or other impoundments.

Watershed Management Area: A tributary area identified in Table B-1 of the Permit. Offsite Alternative Compliance Projects may only provide mitigation for PDP impacts that occur within the same WMA. There are 10 WMAs including: South Orange County, Santa Margarita River, San Luis Rey River, Carlsbad, San Dieguito River, Penasquitos, Mission Bay, San Diego River, San Diego Bay, and Tijuana River.

EXECUTIVE SUMMARY

In May 2013, the San Diego California Regional Water Quality Control Board issued a new **Regional Municipal Stormwater Permit (Permit)** to the San Diego County Copermittees within Regional Board Region 9 with timeframes for extending Permit coverage to the South Orange County and Southwest Riverside County Copermittees by early 2016. The Permit was adopted by the Regional Water Quality Control Board, San Diego Region (Region 9), and only applies to San Diego, and specific areas in Orange and Riverside Counties within Region 9. Changes affecting development and redevelopment projects under the Permit include requiring retention of the 85th percentile storm or biofiltration of 150% of the 85th percentile storm.

The Permit provides Copermittees the option of pursuing "offsite alternative compliance" programs. If instituted by a Copermittee, this allows project applicants within that jurisdiction and defined watershed management area to partially or wholly satisfy pollutant control and hydromodification flow control requirements through offsite projects that achieve a "greater overall water quality benefit." This **Water Quality Equivalency (WQE)** guidance document provides standards and guidelines to determine whether an offsite **Alternative Compliance Project (ACP)** will achieve a greater overall water quality benefit than a **Priority Development Project (PDP)**. As shown in **<u>Figure ES-1</u>**, Copermittees may also need to pursue other program components depending on the scope of the program they intend to implement.

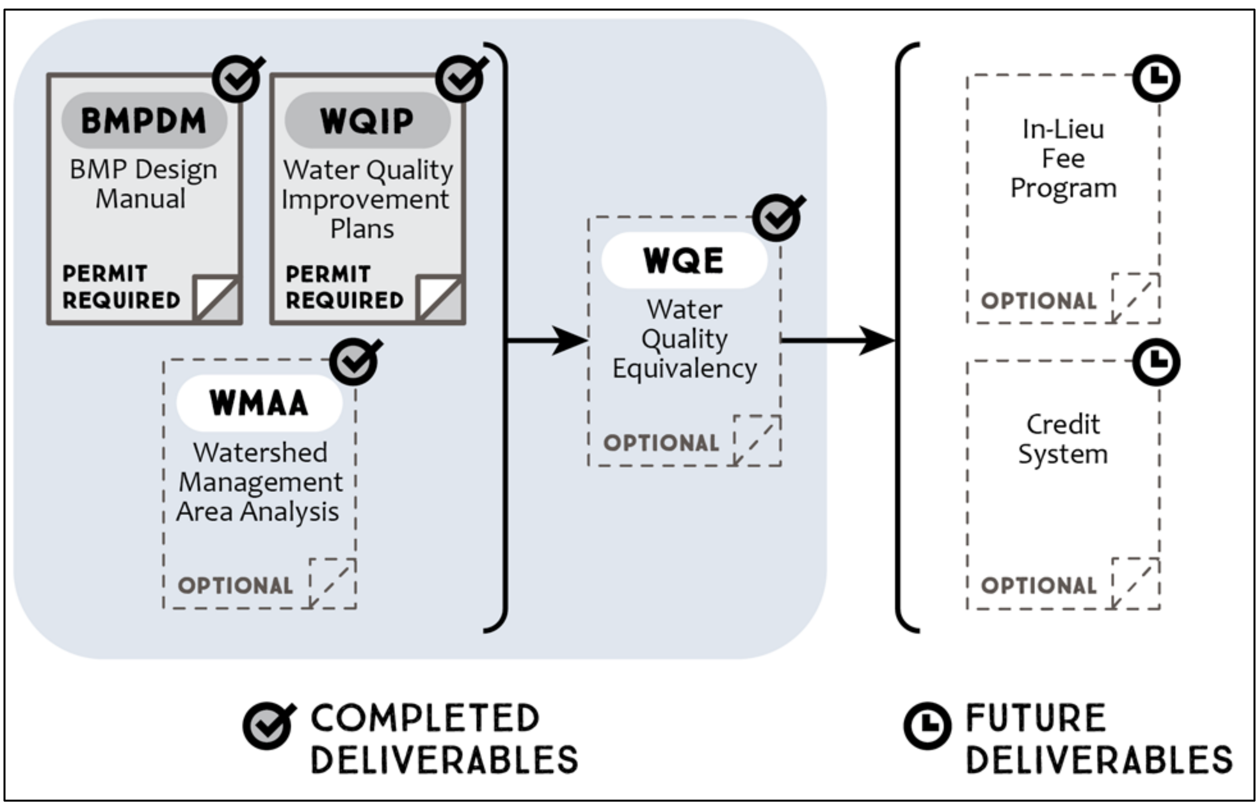

Figure ES-1: Permit Deliverables Related to Offsite Alternative Compliance Program

This document was developed through the combined efforts of a number of parties over an 18-month period of meetings and workshops that elicited input from several sources including a Technical Advisory Committee (TAC), a Stakeholder Advisory Group (SAG), and members of the public. Initial work was funded by the County of San Diego and the cities of San Diego, San Marcos, and Chula Vista and, as the content progressed, additional funding was jointly provided by the 21 Copermittees of the San Diego region. The Counties of Orange and Riverside also provided representation and support throughout this process.

This document sets forth minimum standards for demonstrating water quality equivalency and functions as a user's manual that provides tools to assist applicants and municipalities in the design, review, and approval of projects participating in an offsite alternative compliance program. It is intended to serve as a resource for RWQCB Region 9 Copermittees, ACP and PDP project proponents, non-governmental organizations, RWQCB staff, and other parties with an interest in offsite alternative compliance programs. It is written to function as a companion document to regional stormwater quality documents, some of which are already in effect so it is recommended that readers first familiarize themselves with the completed documents shown in **Figure ES-1**. The methodologies presented herein specify the water quality and HMP values earned by ACP BMPs, which rely on the **BMP Design Manual** (**BMPDM**) applicable to a participating jurisdiction for the design criteria of BMPs. Specific design guidance is not provided in this document.

ES-1. Overall Approach

The WQE calculation methods provided in this document are intended to meet the following criteria:

- They should be simple enough for developers to complete and jurisdictional authorities to review and approve expeditiously.
- They should reflect the current best available science.
- They should reflect differences in pollutant loads from different locations within a watershed.
- They should consider effects on the stability of streams to which PDPs are tributary.
- They should focus solely on quantifying water quality and hydromodification improvements rather than other ancillary benefits not regulated by the Permit.

ES-2. Types and Categories of Alternative Compliance Projects

There are two primary types of ACP: **Structural BMPs** and **Natural System Management Practices (NSMPs)**. Structural BMPs are a subset of BMPs which detain, retain, filter, remove, or prevent the release of pollutants to surface waters from development projects in perpetuity, after construction of the project is completed. These are further subdivided according to the following project categories:

- A **Retrofit BMP** adds or modifies structural BMPs in areas of existing development where practices do not already exist, are ineffective, or can be significantly enhanced.
- A **Regional BMP** treats stormwater from a tributary consisting of more than one development. Its primary purpose is to improve water quality, protect downstream channels, reduce flooding, or to meet other specific jurisdictional water quality objectives.

- A **Water Supply BMP** captures stormwater and infiltrates, pumps, or otherwise replenishes groundwater, surface water reservoirs, or other water supply systems.

NSMPs are practices that are implemented to restore and/or preserve predevelopment watershed functions in lieu of providing direct management of stormwater pollutant control and hydromodification flow control. Natural System Management Practices may include structural or engineered elements as part of the system, but non-engineered elements also provide some level of pollutant control and/or hydromodification management benefits. Natural System Management Practices include the following project categories:

- **Land Restoration** permanently restores currently developed land back to a stabilized, pre-development condition. Land Restoration may provide quantifiable stormwater pollutant control and hydromodification flow control benefits by restoring the predevelopment stormwater runoff volumes, peak flows, and pollutant concentrations of a tributary.
- **Land Preservation** permanently preserves undeveloped land in its current state. In limited scenarios, Land Preservation may provide quantifiable stormwater pollutant control and hydromodification flow control benefits by preventing increases in stormwater runoff volumes, peak flows, and pollutant concentrations associated with the future built out condition of a tributary.
- **Stream Rehabilitation** restores a stream to a natural, stabilized condition that can accommodate both legacy and future hydromodification impacts. Stream Rehabilitation may provide quantifiable hydromodification flow control benefits through permanent stabilization of streams. In limited scenarios, Stream Rehabilitation may also provide quantifiable stormwater pollutant control benefits by reducing impervious channel surfaces.

Methods and guidance needed to support offsite alternative compliance opportunities for various implementation scenarios are provided throughout this document; however, a number of limitations on their use and/or applicability currently exist. Users should therefore remain aware of the specific intended uses of the document and the limitations that currently apply to those uses. **Table ES-1** presents these limitations by ACP category and benefit type. It is understood that some stream restoration techniques should reduce volumes of runoff through infiltration within streambeds. The techniques for quantifying this volume reduction have not been developed as of yet, nor have the design criteria for stream restoration to achieve additional infiltration. Additionally, pollutant reduction associated with changes in riparian vegetation and stream velocities through stream restoration projects have not been assessed or quantified as part of this effort. For an applicant to obtain pollutant reduction credit associated with volume reduction or other pollutant uptake processes in a stream restoration project, the jurisdiction will be required to develop the methodology to be followed through its own approval processes. Many of these issues will hopefully be resolved in the future through additional research and methods development. In particular, limitations on pollutant reduction methods for NSMPs and the limited availability of pollutant reduction efficiencies for flow-thru BMPs are considered priorities for future resolution.

In practice, project applicants will encounter two types of ACP implementation scenarios: **Applicant-Implemented scenarios**, where ACPs are owned or constructed by the same party that is generating a

PDP impact; and **Independent scenarios**, where applicants seek to establish water quality credits for future use (i.e., banking, tracking, trading, and/or selling) through participation in an optional Credit System or In-lieu-Fee Program. Unless these optional supporting components are developed, this document supports the use of WQE credits generated only for Applicant-Implemented scenarios.

Table ES-1: ACP Categories Quantified Through Water Quality Equivalency Guidance

ACP Category	Stormwater Pollutant Control Benefits				Hydromod Flow Control Benefits
	Pollutant Reduction			Volume Reduction	
	Retention	Biofiltration	Flow-Thru		
BMP					
Retrofit	**Available**	**Available**	Limited Availability	**Available**	**Available**
Regional	**Available**	**Available**	Limited Availability	**Available**	**Available**
Water Supply	**Available**	**Available**	Limited Availability	**Available**	**Available**
NSMP					
Land Restoration	*Not Available*	*Not Available*	*Not Available*	**Available**	**Available**
Land Preservation	*Not Available*	*Not Available*	*Not Available*	Limited Availability	**Available**
Stream Rehabilitation	*Not Available*	*Not Available*	*Not Available*	Limited Availability	**Available**

ES-3. Water Quality Equivalency Calculations for Stormwater Pollutant Control

Water quality equivalency for stormwater pollutant control is based on a metric of stormwater volume. The Permit requires that PDPs provide effective stormwater treatment through onsite retention of the Design Capture Volume (DCV) or, if not feasible, biofiltration of 150% of the DCV. For Stormwater Pollutant Control, achieving a "greater overall water quality benefit" means demonstrating that the Earned Stormwater Pollutant Control Volume ($\mathbf{V_E}$) from the ACP is equal to or greater than the deficit of effectively treated stormwater from a PDP. As shown in **Figure ES-2**, three fundamental steps must be performed to determine whether or not this standard will be met.

Step 1: PDP Stormwater Pollutant Control Impacts

The first step is to determine the Deficit of Stormwater Pollutant Control Volume associated with a PDP. This consists of three tasks: defining the required PDP pollutant control, defining the provided PDP pollutant control, and determining the subsequent Deficit of Stormwater Pollutant Control Volume. This step is not required for applicants constructing Independent ACPs because they are constructed without knowledge of specific PDP impacts.

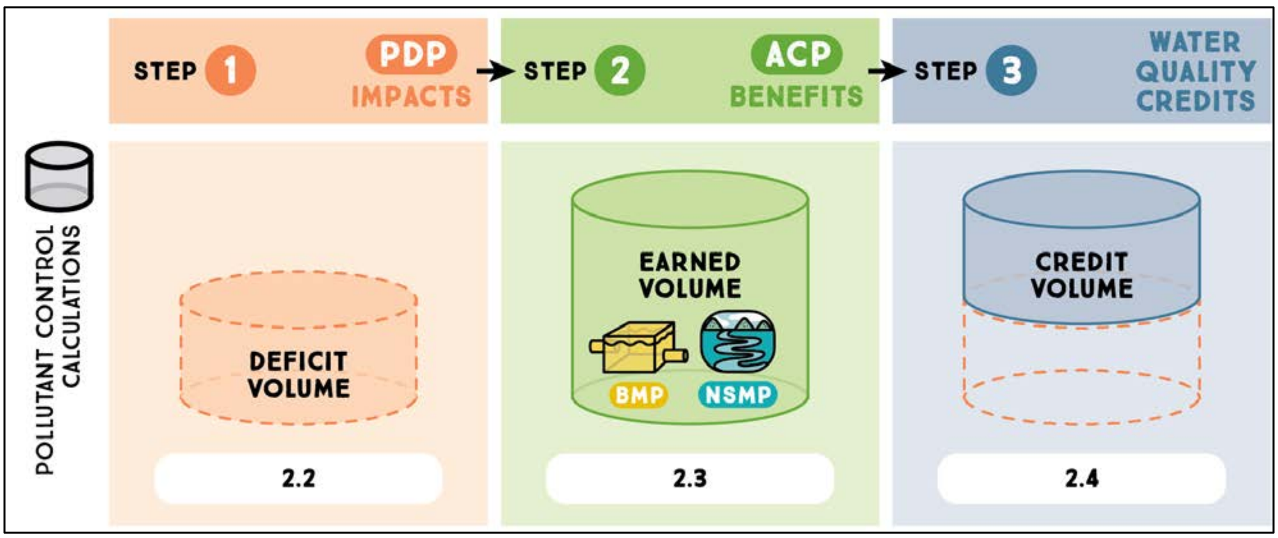

Figure ES-2: WQE Process for Stormwater Pollutant Control

Step 2: ACP Stormwater Pollutant Control Benefits

The second step is to determine the stormwater pollutant control benefits provided by an ACP. This consists of four tasks: DCV calculations, land use factor calculations, BMP efficacy determination, and determination of Earned Stormwater Pollutant Control Volume ($\mathbf{V_E}$). V_E is the volume of water that is effectively treated by the ACP considering the site-specific factors presented in **Equation ES-1**.

Equation ES-1: Calculation of ACP Earned Stormwater Pollutant Control Volume

$$V_E = L\,(\Delta V + V_2 B_2 - V_1 B_1)$$

Where:

V_E: Earned Stormwater Pollutant Control Volume (ft^3)

L: Land Use Factor

ΔV: Change in Design Capture Volume ($V_1 - V_2$)

V_1: Impacted Condition Design Capture Volume for ACP

V_2: Mitigated Condition Design Capture Volume for ACP

B_1: Impacted Condition BMP Efficacy Factor

B_2: Mitigated Condition BMP Efficacy Factor

This credited volume is typically less than the actual volume treated by the ACP due to site-specific factors that take into account relative differences in pollutant loads and efficacies of ACP BMPs compared to onsite retention or biofiltration for PDPs. It is determined according to the general process illustrated in **Figure ES-3**.

The Earned Stormwater Pollutant Control Volume ($\mathbf{V_E}$) can be used to offset the deficit of retained or biofiltered stormwater volume for PDPs either for Applicant-Implemented ACPs (concurrent proposal of a PDP and ACP) or for Independent ACPs (credited for application toward future PDP impacts). Although this calculation is fundamentally the same for Structural BMPs and Natural System Management Practices, project-specific application differs between the two types of project categories: ACP stormwater pollutant control calculations for structural BMPs; and ACP stormwater pollutant control calculations for natural system management practices. These differences are described in greater detail within the report.

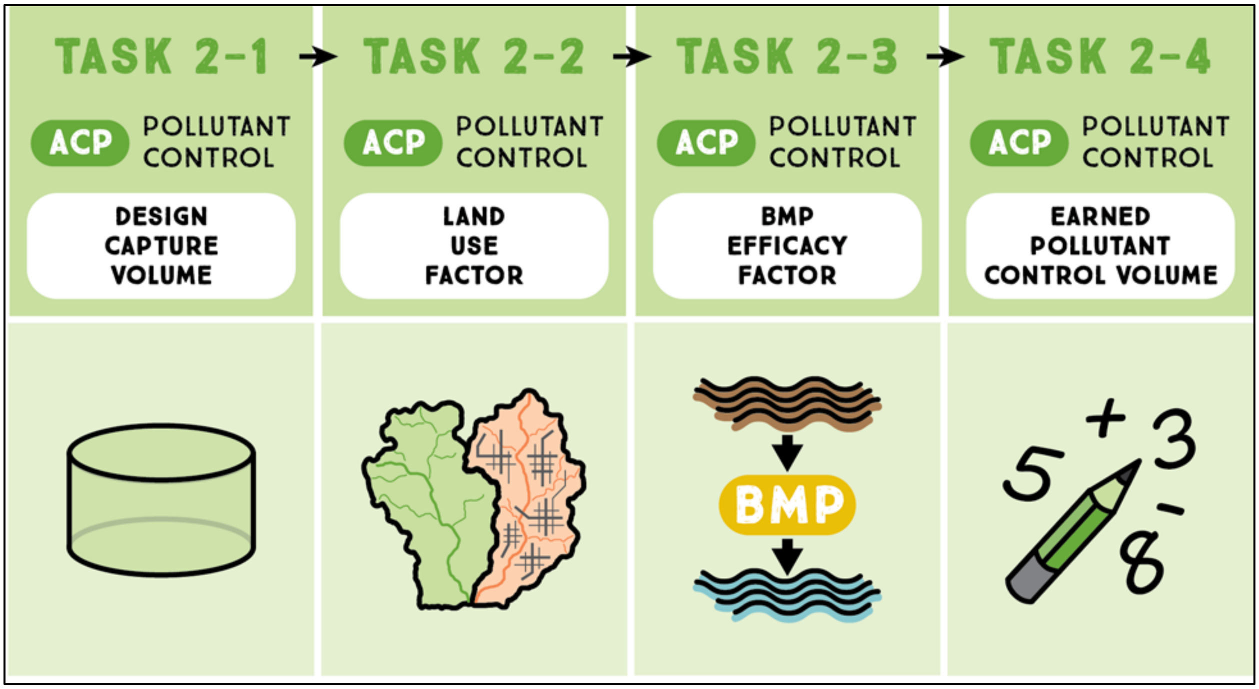

Figure ES-3: ACP Stormwater Pollutant Control Calculations

Task 2-1: Design Capture Volume (DCV)

The DCV tributary to the ACP is determined through the same methodology outlined for PDPs in the BMP Design Manual. ACP applicants must determine DCV values for both **impacted** (**V_1**) and **mitigated** (**V_2**) ACP conditions and then calculate the **difference between the two** (**ΔV**).

Task 2-2: Land Use Factor (L)

The **Land Use Factor** (**L**) is the ratio of pollutant concentrations generated by an ACP tributary compared to the pollutant concentrations generated by a reference PDP tributary with emphasis on the pollutants for which the receiving water in the watershed management area in impaired. Its purpose is to account for variations in the pollutant concentrations delivered to ACPs and PDPs. This factor is needed because ACPs may offset PDP impacts from anywhere within the same watershed management area (WMA). Applicants must conduct a number of pollutant and land use specific calculations and then select the Land Use Factor values that are the most protective for use in **Equation ES-1**.

Task 2-3: BMP Efficacy Factors (B)

The **BMP Efficacy Factor** (**B**) describes the ability of an ACP to remove pollutants in runoff from the drainage area. This factor is represented as a ratio and can vary from 0.00 to 1.00. A BMP Efficacy Factor of 1.00 indicates that an ACP provides a pollutant capture efficacy that meets the PDP BMP efficacy standards set forth in the Permit, while a lower value provides a fraction of that efficacy. The BMP Efficacy Factor is a product of two variables, the **Pollutant Removal Efficiency** (**E**), and the **Provided Capture** (**C**).

Pollutant Removal Efficiency accounts for variations in the ability of different BMPs to remove pollutants in runoff delivered to an ACP site. **Table ES-2** summarizes the standard Pollutant Removal Efficiency values utilized in this guidance.

Table ES-2: Pollutant Removal Efficiency by BMP Type

BMP Type	Pollutant Removal Efficiency (E)
Retention	1.00
Biofiltration	0.666
Partial Retention	1.00 for retention portion 0.666 for biofiltration portion
Flow-Thru	Currently unknown, refer to **Section 2.3.1.3.1** for a framework to establish values.
Treatment Train	Values from rows above

The Provided Capture value provides a mechanism to quantify the water quality benefits provided by an ACP with design parameters that differ from the standard sizing requirements provided in the applicable BMPDM.

Step 3: Determination of Stormwater Pollutant Control Credits

Greater overall water quality benefit for stormwater pollutant control is established by demonstrating that the V_E from an ACP is greater than or equal to the Deficit of Stormwater Pollutant Control Volume from a PDP. This demonstration is done by simply subtracting the volume determined in **Step 2** by the volume determined in **Step 1** and ensuring the result is greater than or equal to zero.

ES-4. Water Quality Equivalency Calculations for Hydromodification Flow Control

The hydromodification flow control equivalency currency is **directly connected impervious area** (**DCIA**) effectively managed. The rationale for selecting this currency is that mitigating one directly connected impervious acre is as valuable as mitigating another directly connected impervious acre, as long as strict requirements for the location of the ACP relative to the PDP are met.

Hydromodification Flow Control Equivalency for Structural BMPs

Hydromodification flow control equivalency guidance allows for ACPs such as retrofits, regional BMPs, groundwater recharge projects, and water supply projects to provide quantifiable hydromodification management flow control benefits that can be used to offset impacts associated with a PDP. This guidance document discusses flow control facilities as ACPs and describes the hydromodification flow control equivalency currency, and specific rules to apply the currency. Users are assumed to be familiar with both the "Final Hydromodification Management Plan Prepared for County of San Diego, California," which describes the development of performance standards for control of hydromodification in San Diego County, and provides important information about the concepts behind the performance standards; and the "Model BMP Design Manual San Diego Region," (or any other BMPDM applicable to the jurisdiction) which presents the performance standards updated to meet 2013 MS4 Permit requirements.

Location requirements are necessary to prevent the PDPs from creating a new impact to a stream through the addition of new impervious area draining directly to the stream without mitigation. These requirements are summarized in **Table ES-3**.

Table ES-3: ACP Location Requirements by PDP Scenario Type

PDP Scenario Type	ACP Location Requirements
• **New Development** • **Redevelopment Increasing Impervious Area**	• ACP location must be within the same local watershed/system (drains to the same susceptible receiving water as the PDP), AND • Mitigation must be provided at or before the discharge point to the susceptible receiving water, AND • The total existing DCIA draining to the ACP must be greater than or equal to the PDP DCIA to be mitigated (i.e., the drainage area draining to the ACP must generate as much or more runoff as the PDP area requiring mitigation).
• **Redevelopment with NO increase in impervious area**	• ACP location must be within the same hydrologic unit but does not have to be within the same local watershed/system (may drain to a different susceptible receiving water within the same hydrologic unit), AND • ACP location must not be an HMP exempt location, AND • The total existing DCIA draining to the ACP must be greater than or equal to the PDP DCIA to be mitigated (i.e., the drainage area draining to the ACP must generate as much or more runoff as the PDP area requiring mitigation).

The Model BMP Design Manual presents several accepted models for calculating HMP Q and volume for flow control facilities. Any accepted model may be used to design an applicant-implemented or independent ACP. The designer of the ACP shall use the version of the BMP Design Manual that is in effect at the time of the ACP development permit application.

A process for hydromodification flow control equivalency calculations of equivalent DCIA is presented in the report. Calculations to design a flow control facility may require continuous simulation modeling, which is outside the scope of this guidance document. Refer to the BMP Design Manual for methods and parameters for continuous simulation modeling.

Hydromodification Flow Control Equivalency for Stream Rehabilitation

Hydromodification flow control equivalency for stream rehabilitation is based on the principle that greater overall watershed benefit is achieved when stream rehabilitation measures are designed to mitigate both future and legacy hydromodification impacts associated with development that occurs within the watershed. The amount of rehabilitation that is required is dependent on the current condition of the receiving waters and planned development in the watershed and is anticipated to vary within and between watersheds. As shown in **Figure ES-4**, two scenarios for pursuing hydromodification equivalency credits are envisioned; **PDP-based** and **watershed-based**.

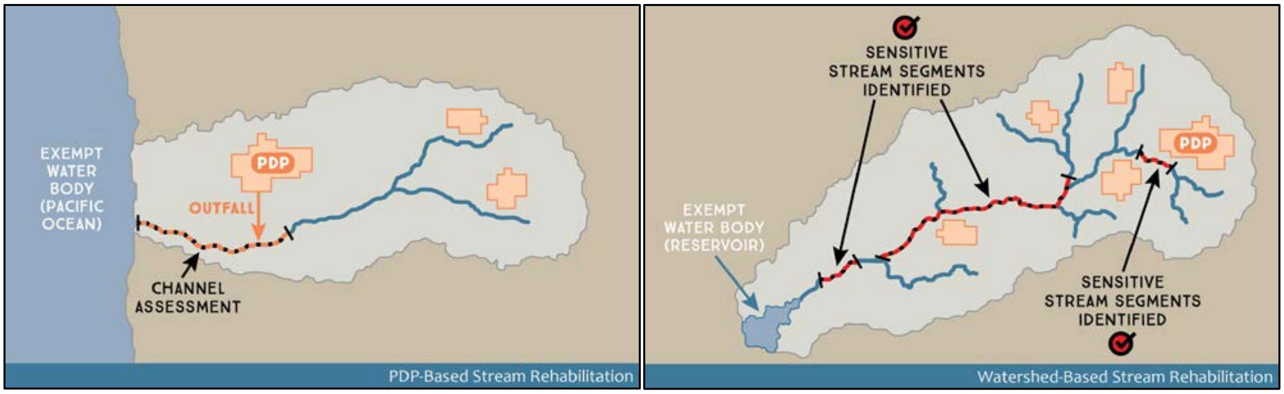

Figure ES-4: Implementation Scenarios for Stream Rehabilitation

PDP-based Equivalency for Stream Rehabilitation

Applicant-Implemented PDP-based stream rehabilitation projects for impacts caused by a PDP and legacy impacts may be allowed if a project would provide a greater overall benefit to the sub-watershed and is approved by the local Copermittee.

In this scenario the PDP must perform a channel assessment for the domain of analysis determined based on the outfall of the PDP. Sensitive stream segments requiring stream rehabilitation must be identified downstream to an exempt water body. The PDP would then rehabilitate the sensitive stream segments in the domain of analysis to the exempt water body. Stream rehabilitation must be designed for the existing condition and additional imperviousness added by the PDP. These activities are only applicable to offset impacts of PDP. That is, they cannot be used to generate credits. Additional future development in the watershed would also be required to implement site-specific hydromodification flow control.

Watershed-based Equivalency for Stream Rehabilitation

In this scenario, applicants conduct a channel assessment process for all stream segments in the sub-watershed that receive flows from planned development projects and identify the sensitive stream segments that require stream rehabilitation. They then rehabilitate the sensitive stream segments in the sub-watershed. Credits are estimated as the sum of (1) new impervious area to be added in the sub-watershed (i.e. developable land and infill); and (2) anticipated redevelopment in the sub-watershed. Credit may only be used for development projects that directly discharge to the assessed streams. For the development project to qualify for credits, all identified sensitive stream segments from the project to the downstream exempt water body must be rehabilitated.

ES-5. Example Water Quality Equivalency Calculations by Project Type

Detailed examples of pollutant reduction and hydromodification management WQE calculations are provided for six specific project types in **Section 4**. They are intended to illustrate a variety of project types and circumstances that might be encountered by users. Three examples each are provided for Structural Best Management Practices (Retrofit BMPs, Regional BMPs, Water Supply BMPs) and Natural System Management Practices (Land Restoration NSMPs, Land Preservation NSMPs, Stream Rehabilitation NSMPs).

1. INTRODUCTION

1.1 Background

In May 2013, the San Diego California Regional Water Quality Control Board issued Order No. R9-2013-0001 (Permit) to the San Diego County Copermittees within Regional Board Region 9. The subsequent issuance of Order No. R9-2015-0001 in February 2015 extended Permit coverage to the Orange County Copermittees, and subsequent issuance of Order No. R9-2015-0100 in November 2015 extended Permit coverage to the Riverside County Copermittees. Changes affecting development and redevelopment projects under the Permit are significant. The Permit lowers the minimum threshold necessary to trigger classification of projects as Priority Development Projects (**PDP**s), sets forth more stringent onsite requirements for stormwater pollutant control and hydromodification management, and allows PDPs to satisfy specific onsite structural best management practices (**BMP**) performance requirements[1] through participation in an ***offsite alternative compliance program***.

To address the updated requirements set forth in the new Permit and support the newly available offsite alternative compliance options, several permit deliverables have been completed[2] or may be explored as optional future deliverables as illustrated in **Figure 1-1**.

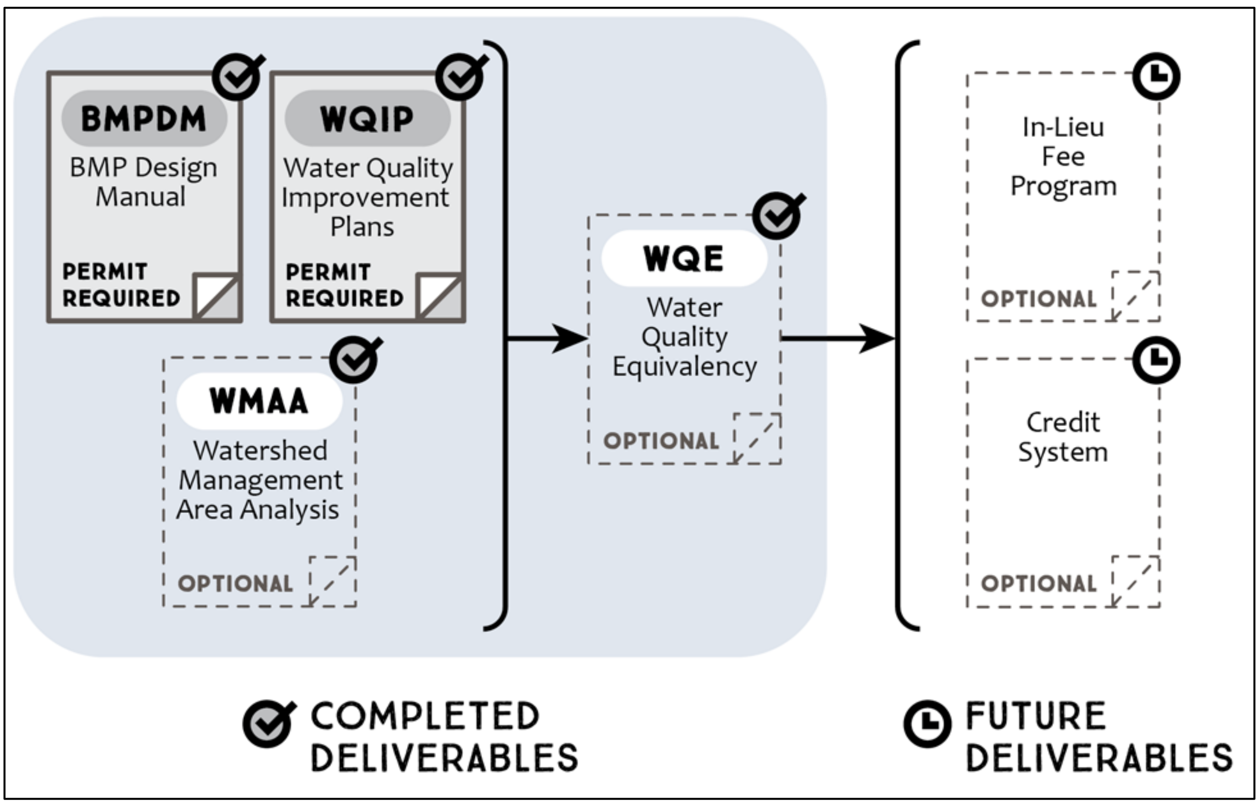

Figure 1-1: Permit Deliverables Related to Offsite Alternative Compliance Program

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[1] *As required by Permit Section E.3.c.*
[2] *As required by Permit Sections E.3.c.(3) and E.3.d.*

As required by the Permit, Copermittee BMP Design Manuals (**BMPDM**s) have been updated to prescribe appropriate development standards necessary to achieve compliance with the updated pollutant control and hydromodification management requirements. Also, Water Quality Improvement Plans (**WQIP**s) have been developed to identify the highest priority water quality conditions within watershed management areas and implement strategies to achieve improvements In order to satisfy prerequisite requirements for development of an optional offsite alternative compliance program, a Watershed Management Area Analysis (**WMAA**) was also completed to map hydrologic characteristics, evaluate hydromodification management exemption criteria, present conceptual offsite alternative compliance project locations, and facilitate planning level efforts for identifying new ACP locations. Findings from the WMAA are divided with respect to Watershed Management Area (**WMA**) and incorporated as appendices within the WQIP submittals.

Finally, this Water Quality Equivalency (**WQE**) guidance document establishes a mechanism to correlate quantifiable Alternative Compliance Project (**ACP**) benefits with PDP impacts. This is necessary to demonstrate that an ACP project provides a ***greater overall water quality benefit*** than fully complying with the onsite stormwater pollutant control and hydromodification management requirements set forth in the Permit and BMPDM. This document sets forth RWQCB-approved guidance that must be followed should an individual Copermittee elect to implement an optional offsite alternative compliance program.[3]

This guidance does not set forth any additional deliverables or components that may be necessary to implement an optional offsite alternative compliance program including: jurisdictional elements (forms, submittal templates, maintenance agreements, monitoring guidelines, etc.) and regional elements (credit systems, in-lieu-fee programs, private-public partnerships, etc.). With the exception of the credit system, which is currently being pursued through a regional effort, utilization of any such additional components is the responsibility of individual jurisdictions to develop and implement.

1.2 Public Process

This document was developed through the combined efforts of a number of parties. Initial work was funded by the County of San Diego and the cities of San Diego, San Marcos, and Chula Vista. As the content progressed, additional funding was jointly provided by the 21 Copermittees of the San Diego region. As summarized in **Table 1-1**, this document was developed over an 18-month period of workshops that elicited input from several sources including a Technical Advisory Committee (**TAC**), a Stakeholder Advisory Group (**SAG**), and members of the public.

The TAC assembled for this process was comprised of a diverse group of representatives from Region 9 Regional Water Quality Control Board (**RWQCB**), Region 9 Copermittees (including representatives within the San Diego, Orange County, and Riverside County areas), and local experts in the fields of engineering, planning, biology, chemistry, law, and academia. The TAC provided valuable input throughout the entire document development process, convening a total of twelve

[3] *If a Copermittee elects to pursue alternate means of demonstrating water quality equivalency, such alternate means must be approved by the San Diego Water Boards Executive Officer pursuant to Permit Section E.3.c.(3)(a).*

times between May 29th, 2014 and July 28th, 2015. A list of TAC participants is provided on the next page.

The SAG assembled for this process was comprised of a broader audience of local interested professionals within Region 9. The SAG provided valuable input at project milestones including project kickoff, substantial completion of the guidance document, and public distribution of the document. SAG comments and associated responses are provided in **Appendix E**. A list of SAG participants is provided on the next page.

Members of the public were notified of participation opportunities in this process via an announcement on Project Clean Water and through utilization of existing email distributions lists for American Public Works Association, American Society of Engineers, Building Industry Association, San Diego Regional Water Quality Control Board, and other sources. Members of the public provided valuable input at project milestones including public distribution of the document and water board submittal of the document, each of which provided a 30-day comment period. Public comments and associated responses are provided in **Appendix E**.

Table 1-1: Public Process Outline

#	Item	Date	Participants	Milestones/Notes
1	TAC/SAG Workshop #1	5/29/14	TAC/SAG	**Project Kickoff** -1 week review
2	TAC Workshop #2	8/26/14	TAC	
3	TAC Workshop #2.5	10/9/14	TAC	
4	TAC Workshop #2.6	10/27/14	TAC	
5	TAC Workshop #3	12/10/14	TAC	1st internal draft distributed, 2 week review
6	BMP Efficiencies Workshop (i)	1/7/15	TAC Subset	
7	TAC Workshop #3.5	1/29/15	TAC	
8	BMP Efficiencies Workshop (ii)	2/24/15	TAC Subset	
9	TAC Workshop #3.6	4/15/15	TAC	2nd internal draft distributed, 2 week comment period
10	TAC/SAG Workshop #4	5/19/15	TAC/SAG	**Substantial Completion** - 3rd internal draft distributed, 2 week review
11	TAC Workshop #4.5	6/17/15	TAC	
12	Public Workshop	7/28/15	Public	**Public Draft Distribution** - 30 day public review
13	San Diego Water Board Submittal #1	9/18/15	N/A	**Water Board Submittal -** 30 day public review
14	San Diego Water Board Final Submittal	12/17/2015	N/A	**Final Document Approved**

TAC Participants:
Alsop, Trevor | Arias, Christina | Becker, Eric | Boaz, Trish | Boon, Richard | Bowling, Dennis | Chiu, Wayne | Collacott, Bob | Crompton, Chris | Dowden, Doug | Evetovich, Silvester | Garcia, David | Gearheart, Greg | Gonzalez, Gladys | Grey, Mark | Gummadi, Venkat | Haimann, Richard | Hasenin, Sumer | Henry, Laura | Hiemstra, Ray | Hinds, Juli Beth | Humphreys, Sharon | Janda-Timba, Jayne | Leiter, Bob | Lomeli, Eric | Louie, Sarah | Mattson, Michelle | McPherson, Sheri | McSweeney, Michael | Mohrlock, Charles | Mosolgo, Eric | Ogawa, Mikhail | Pohl, Dr. David | Rosenbaum, Wayne | Ryan, Erica | Salem, Boushra | Seits, Mark | Shamblin-Gray, Stephanie | Stein, Dr. Eric | Taylor, Scott | Thornberry, Reed | Uhley, Jason | Van Rhyn, Jon | Walker, Tory | Walsh, Laurie | Yeager, Matt

SAG Participants:
Allen, Vaikko | Crumpacker, Andrea | Dadkhah, Arsalan | Davies, Helen | Evans, Bryn | Fougeres, Dorian | Fowler, Brad | Jones, Cory | Lahsaiezadeh, Mo | Lucera, Rich | Maher, Masih | Najera, Crystal | O'Malley, Matt | Schaefer, Christina | Schillinger, Hal | Sprecco, Eddie | Surban, Ramesses

Consultant Support:
Rick Engineering | HDR | Parsons Brinckerhoff | Geosyntec | Environmental Science Associates | Center for Collaborative Policy (facilitation support) | Pi Environmental (graphic support)

1.3 General Concepts

This guidance document presents the methodologies used to determine the ***water quality benefits*** associated with an ACP as well as the ***water quality impacts*** associated with a PDP, and outlines how such benefits and impacts may offset one another through participation in an offsite alternative compliance program. Because the methodologies presented here dictate the benefits earned by BMPs, this guidance document will likely have a significant influence how applicants elect to design BMPs; however, no specific design guidance is provided in this document. Applicants must adhere to local engineering standards and BMPDM criteria set forth by their respective jurisdiction.

Categories of Water Quality Equivalency: In alignment with the structural BMP performance requirements set forth in the Permit, this guidance document addresses water quality equivalency according to two broad categories; stormwater pollutant control and hydromodification management. **Figure 1-2** provides an overview of the processes for determining water quality equivalency for both of these categories. These processes are explored in detail in **Sections 2** and **3**.

General Alternative Compliance Project (ACP) Types: Two types of Alternative Compliance Projects (ACPs) are addressed in this document; ***Applicant-Implemented ACPs*** and ***Independent ACPs***. Applicant-Implemented ACPs are projects initiated to offset specific PDP stormwater impacts that were not fully addressed onsite. In an Applicant-Implemented scenario, an ACP is purchased or constructed by the same party that is generating a PDP impact. Both projects are under the control of the same party, so a credit system to track and trade associated impacts and benefits is not required. However, if an Applicant-Implemented ACP does result in the generation of excess credits, a credit system would be required before such credits could be traded. In an

Applicant-Implemented ACP scenario the applicant is able to identify specific information related to both the PDP and ACP sites; therefore, applicants are required to consider site-specific information for both sites in the determination of water quality benefits and impacts.

Independent ACPs are projects initiated independently of specific PDP impacts in an effort to provide water quality benefits, contribute towards total maximum daily load (**TMDL**) goals, and/or generate water quality credits for banking in a credit system. In an Independent ACP scenario, a party other than the PDP applicant owns or constructs an ACP. Both projects are under the control of different parties, so a credit system must be in place before offsetting water quality impacts and benefits can be traded. Because Independent ACPs are designed and constructed without knowledge of or regard to specific PDPs, the methods to perform water quality equivalency calculations for such ACPs deviate slightly from the methods required for Applicant-Implemented ACPs.

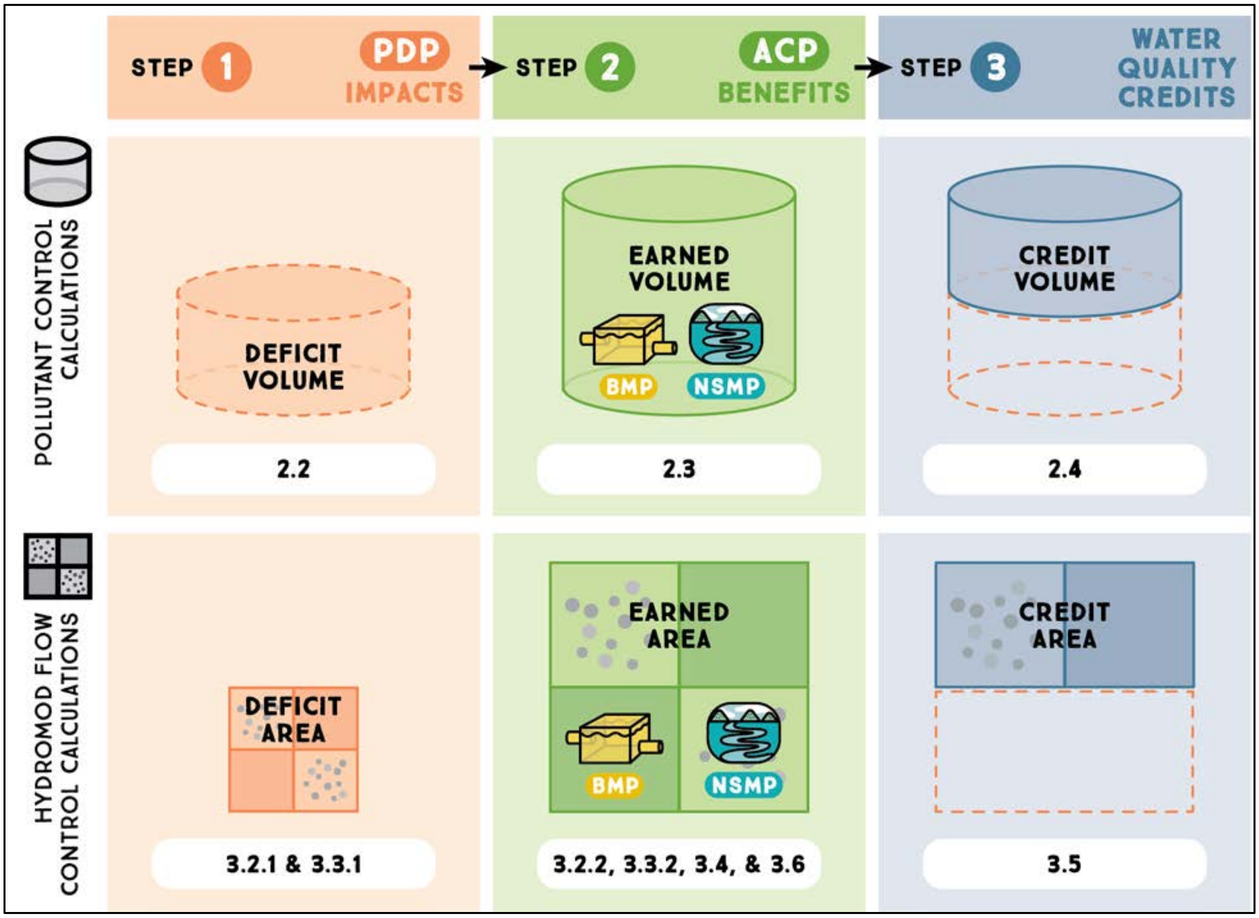

Figure 1-2: WQE Process for Stormwater Pollutant Control and Hydromodification Management

<u>Specific Alternative Compliance Project Categories:</u> Within each of the broad ACP types described above, projects are further subdivided in this document according to several specific categories. Each of these categories is broadly classified either as a ***Structural BMP*** or a ***Natural System Management Practice***. As defined in the MS4 Permit, structural BMPs are a subset of BMPs which detain, retain, filter, remove, or prevent the release of pollutants to surface waters from development projects in perpetuity, after construction of a project is completed. A structural BMP

may be a pollutant control BMP, a hydromodification management BMP, or an integrated pollutant control and hydromodification management BMP. **Natural System Management Practices** are stormwater management practices implemented to restore and/or preserve predevelopment watershed functions in lieu of providing direct pollutant removal and hydromodification flow control. NSMPs may include structural or engineered elements, but these elements do not expressly provide stormwater pollutant removal. NSMPs include Land Restoration, Land Preservation, and Stream Rehabilitation projects.

Water Quality Equivalency Metrics: Depending on the type of benefit or impact being considered, either of two types of metrics may be considered for a given project scenario. Water quality equivalency for stormwater pollutant control is established based on a metric of stormwater volume. The metric of stormwater volume provides a direct link to Permit requirements for onsite stormwater pollutant control of the design capture volume (**DCV**). PDP impacts are calculated as a ***Deficit of Stormwater Pollutant Control Volume*** per guidelines set forth in the BMPDM and **Section 2.2**. Any deficit in stormwater pollutant control volume at a PDP site indicates a need for onsite flow-thru treatment and offsite mitigation. ACP benefits are calculated as an ***Earned Stormwater Pollutant Control Volume***, which includes several factors specific only to ACPs, per guidelines set forth in **Section 2.3** and the BMPDM. Finally, as discussed in **Section 2.4**, water quality equivalency for stormwater pollutant control is demonstrated when the stormwater pollutant control benefits provided by the ACP are greater than or equal to the stormwater pollutant control impacts generated by the PDP.

The establishment of water quality equivalency for hydromodification flow control is based on a metric of impervious area. PDP impacts are calculated as a ***Deficit of Total Impervious Area Effectively Managed*** per guidelines set forth in the BMPDM and **Section 3.2.1**. Any Deficit of Total Impervious Area Effectively Managed indicates a need for offsite mitigation. ACP benefits are calculated as an ***Earned Directly Connected Impervious Area Effectively Managed*** per guidelines set forth in the BMPDM and **Sections 3.2.2, 3.3.2, 3.4, and 3.6**. Finally, as discussed in **Section 3.5**, and shown in Figure 1-2 above, water quality equivalency for hydromodification flow control is demonstrated when the hydromodification flow control benefits from the ACP are greater than or equal to the hydromodification flow control impacts generated by the PDP.

Combined ACP Benefits: An ACP may provide stormwater pollutant control benefits, hydromodification flow control benefits, or any combination of the two through construction of a single BMP provided that design is capable of accommodating both requirements. Such a design would generate Earned Stormwater Pollutant Control Volume and Earned Directly Connected Impervious Area Effectively Managed.

Partial ACP Benefits: Partial stormwater pollutant control and/or hydromodification flow control benefits may be provided at PDP and ACP sites. Prior to implementing an ACP, a PDP applicant may elect to reduce their offsite needs by partially satisfying onsite requirements for stormwater pollutant control and/or hydromodification flow control as described in **Sections 2.2** and **3.2.1** respectively. Alternatively, an ACP applicant may elect to generate partial benefits by partially satisfying these requirements for the ACP tributary as outlined in **Sections 2.3.1** and **3.5**.

Water Quality Credits and Credit Systems: *If stormwater pollutant control and/or hydromodification flow control benefits associated with an ACP are greater than the respective impacts from the PDP, an applicant may generate stormwater pollutant control and/or hydromodification flow control credits for participation in a potential future credit system. Credits for stormwater pollutant control and hydromodification flow control will be generated independently and are calculated as the difference between ACP benefits and their respective PDP impacts.*

This document does not authorize or provide guidance or standards for the use of credit systems by Copermittees. The development and implementation of these systems is subject to all applicable Permit provisions. In particular, credit systems require review and acceptance by the RWQCB prior to their implementation. However, subject to applicable Permit provisions and local jurisdictional requirements and approvals, ACPs may be eligible to generate credits for potential future banking, tracking, trading, and selling even if approved prior to the RWQCB acceptance of a credit system. To do so, the local jurisdictional approval of the ACP must have occurred on or after the RWQCB acceptance of this document (December 17, 2015). This date applies for all ACPs approved by a Copermittee, including those subject to the conditions of any future iterations or modifications to this document, or of other Water Quality Equivalency calculations accepted by the RWQCB. Qualifying approvals for ACPs or ACP categories are not addressed in this document. They must instead be defined as part of the RWQCB accepted credit system under which the credits will be applied.

Credits for an ACP may not actually be generated until acquisitions, improvements, construction or other actions needed to satisfy all applicable crediting requirements are complete and the ACP has been accepted into a qualifying credit system. Initial approvals do not provide a guarantee that an ACP will ultimately qualify to generate credits if applicable Permit or local jurisdictional requirements are not met or substantial conformity with these approvals is not maintained.

Location Restrictions: The Permit restricts the use of offsite alternative compliance to projects located within the same WMA. Additionally, circumstances creating specific conditions at a PDP or ACP site location may require more stringent location-based restrictions for offsite alternative compliance. These restrictions are presented in **Sections 2.3.1.2, 3.3,** and **3.6.**

Onsite Alternative Compliance: In some instances a PDP applicant may provide stormwater pollutant control and/or hydromodification flow control benefits by managing offsite stormwater flows that are conveyed to their PDP site. Provided that the flows originating onsite are (at a minimum) flow-thru treated with medium to high efficacy, management of offsite flows may potentially be used to partially or wholly satisfy onsite stormwater performance standard requirements. Onsite alternative compliance scenarios may create additional complexities with respect to stormwater diversion, comingling, maintenance, and enforcement; therefore, such projects may be accepted and conditioned at the discretion of the applicable Copermittee.

1.4 Use of this Document

This document sets forth minimum standards for demonstrating water quality equivalency and functions as a user's manual to provide the tools necessary to assist applicants and municipalities in the design, review, and approval of projects participating in an offsite alternative compliance program. It is intended to serve as a resource for Region 9 Copermittees, ACP and PDP project proponents, non-government organizations, RWQCB staff, and other parties with an interest in offsite alternative compliance programs. It is written to function as a companion document to regional stormwater quality documents, some of which are already in effect, so it is recommended that readers first familiarize themselves with the following documents:

- **2013 Municipal Separate Storm Sewer Systems Permit (Permit):** At a minimum, readers should be familiar with PDP threshold criteria (Section II.E.3.b.) and Structural BMP Performance Requirements (II.E.3.c.).
- **Model BMP Design Manual, June 2015 (BMPDM):** At a minimum, readers should be familiar with PDP threshold criteria (Section 1), Stormwater Pollutant Control Requirements (Section 5) Hydromodification Management Requirements (Section 6).
- **Individual Copermittee Documents:** Jurisdiction-specific BMPDMs and/or implementing documents as subsequently adopted by Copermittees of the Permit.

This document should be referred to by PDP applicants that are interested in proposing Applicant-Implemented ACPs, or by parties proposing Independent ACPs. It is organized as follows:

- **Section 1** provides an introduction to updated Permit requirements and provides an overview of general water quality equivalency concepts, intended uses, and limitations.

- **Section 2** presents a three-step procedure to establish equivalency for stormwater pollutant control. Several general examples are also provided to illustrate and contextualize the technical material presented.

- **Section 3** provides a comprehensive overview of the methodologies used to establish equivalency for hydromodification flow control. Several general examples are also provided to illustrate and contextualize the technical material presented.

  Applicants must fully comply with all applicable standards and guidelines described in **Sections 2 and 3**. The general organization of these sections, including references to applicable subsections, is illustrated in **Figure 1-3**.

- **Section 4** builds on the content provided in Sections 2 and 3 to provide sample calculations for the following ACP categories: Retrofit BMPs, Regional BMPs, Water Supply BMPs, Land Restoration ***Natural System Management Practices*** **(NSMPs)**, Land Preservation NSMPs, and Stream Rehabilitation NSMPs.

- **Appendix A** provides relevant worksheet templates for water quality equivalency calculations.

- **Appendix B** provides reference information and supporting material pertaining to stormwater pollutant control requirements. This information is presented for reference only.
- **Appendix C** provides reference information and supporting material pertaining to hydromodification flow control requirements. This information is presented for reference only.
- **Appendix D** provides full size exhibits of relevant water quality equivalency material such as Event Mean Concentration Land Use Maps and Watershed Management Area/Hydrologic Unit Maps.
- **Appendix E** provides responses to public comments submitted at project milestones including: substantial completion, public draft distribution, and water board submittal. This information is presented for reference only.

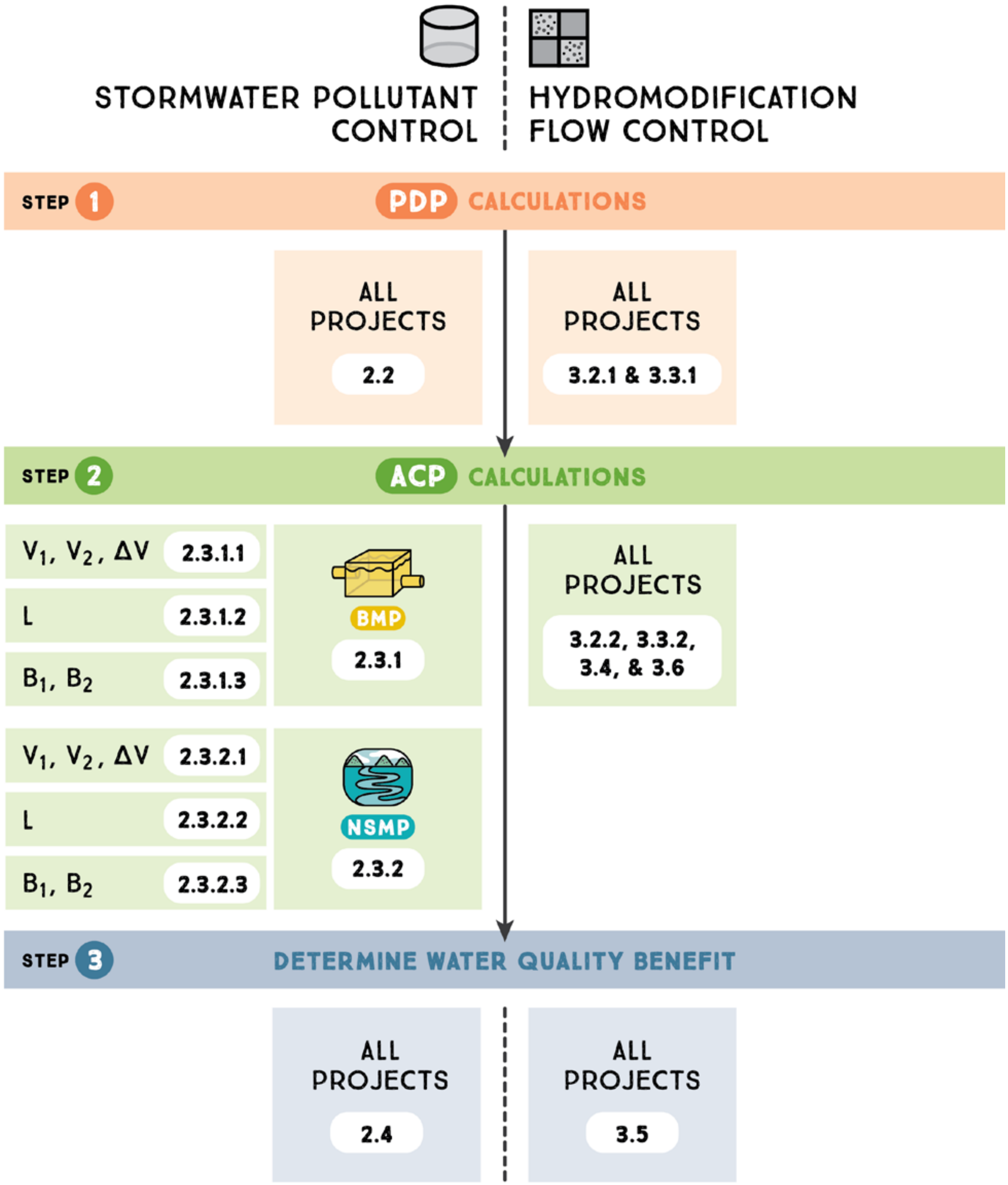

Figure 1-3: Stormwater Pollutant Control and Hydromodification Flow Control Process

1.5 General Considerations and Limitations

While this document provides methods and guidance needed to support offsite alternative compliance opportunities for various implementation scenarios, a number of limitations on its use and/or applicability currently exist. Many of these issues will hopefully be resolved in the future through additional research and methods development. However, as described below, users should be aware of the specific intended uses of the document and the limitations that apply to those uses.

- Optional Jurisdictional Participation: Participation in an offsite alternative compliance program is entirely at the discretion of individual jurisdictions. This document applies only to projects within jurisdictions that have opted to participate in an offsite alternative compliance program.

- Additional Programmatic Requirements for Independent ACPs: In concept, offsite alternative compliance programs can include both Applicant-Implemented ACPs and Independent ACPs. However, only Applicant-Implemented ACPs may be supported solely through the completion of water quality equivalency standards. As noted, credit trading elements needed for Independent ACPs also require the establishment of a credit system and/or in-lieu-fee structure by the participating jurisdiction.

ACPs may produce a number of benefits that are important to surrounding communities and habitats. In many cases these benefits are beyond the scope of the structural performance requirements of the Permit, or cannot be quantified or correlated to these requirements with present-day knowledge. As such the quantifiable benefits available for some ACP categories are limited. **Table 1-2** summarizes their current status. Additional explanation is also provided below and as applicable throughout the remainder of this document.

- Pollutant Removal Efficiencies for Flow-Thru BMPs: Methods to quantify stormwater pollutant control benefits provided by flow-thru BMPs are generally supported within this document; however, due to extreme variations in the design and subsequent pollutant removal data available for flow-thru BMPs, this guidance does not provide standardized pollutant removal efficiencies for use in WQE formulas. While it allows the utilization of flow-thru BMPs, their use is contingent on meeting the conditions described in **Section 2.3.1.3.1**. It should be noted that in some cases it is possible to make minor design modifications to re-classify flow-thru BMPs to volume-based BMPs (i.e. adding check-dams to a lined vegetated swale would reclassify the BMP as a biofiltration BMP) and that effective incorporation of vegetative flow-thru BMPs may generate stormwater pollutant control benefits by effectively reducing the tributary DCV.

- Metrics for Natural System Management Practices: Specific metrics to quantify stormwater pollutant removal efficiencies provided by Natural System Management Practices (NSMPs) such as land restoration, land preservation, and stream rehabilitation are not included in this document; however, such systems can still provide stormwater pollutant control benefits through a reduction in stormwater runoff volume rather than through incorporation of engineered pollutant removal elements. Similarly, land restoration and land preservation

NSMPs may also provide hydromodification flow control benefits through a reduction in directly connected impervious surfaces, rather than engineered flow control. Finally, stream rehabilitation may provide hydromodification flow control benefits through restoration of streams to a stable condition.

Table 1-2: ACP Categories Quantified Through Water Quality Equivalency Guidance

ACP Category[1]		Stormwater Pollutant Control Benefits				Hydromod Flow Control Benefits
		Pollutant Reduction			Volume Reduction	
		Retention	Biofiltration	Flow-Thru		
BMP	**Retrofit**	**Available**	**Available**	Limited Availability[2]	**Available**	**Available**
BMP	**Regional**	**Available**	**Available**	Limited Availability[2]	**Available**	**Available**
BMP	**Water Supply**	**Available**	**Available**	Limited Availability[2]	**Available**	**Available**
NSMP	**Land Restoration**	*Not Available*	*Not Available*	*Not Available*	**Available**	**Available**
NSMP	**Land Preservation**	*Not Available*	*Not Available*	*Not Available*	Limited Availability	**Available**
NSMP	**Stream Rehabilitation**	*Not Available*	*Not Available*	*Not Available*	Limited Availability	**Available**

Notes:

1. All ACPs must satisfy the specific water quality equivalency guidelines set forth for the associated ACP category in this document. Applicants may refer to **Figure 1-3** in order to identify which sections must be referenced in order to satisfy the applicable WQE guidance for stormwater pollutant control and hydromodification flow control.
2. Flow-thru BMPs may only generate quantifiable stormwater pollutant control benefits if the applicant establishes appropriate pollutant removal efficiencies to the satisfaction of the applicable Copermittee as outlined in **Section 2.3.1.3.1.**

2. WATER QUALITY EQUIVALENCY CALCULATIONS FOR STORMWATER POLLUTANT CONTROL

2.1 Overview of Methodology

Water quality equivalency for stormwater pollutant control is established based on a metric of stormwater volume. The Permit requires that PDPs provide effective stormwater treatment through onsite retention (interception, storage, infiltration, evaporation, and evapotranspiration) of the DCV. Where full retention of the DCV is not technically feasible, biofiltration may be provided either through biofiltration of 1.50 times the remaining DCV, or biofiltration of the remaining DCV with a design that can accommodate at least 0.75 times the DCV within the pore spaces and pre-filter detention volume. Alternatively, if a jurisdiction has an offsite alternative compliance program in place, applicants may utilize onsite flow-thru treatment control BMPs that provide a medium to high pollutant removal efficiency to treat runoff leaving the site, and then also mitigate for the DCV not reliably retained onsite through participation in an offsite alternative compliance program.

If a PDP applicant proposes to utilize offsite alternative compliance to satisfy onsite stormwater pollutant control requirements, they must demonstrate that the Earned Stormwater Pollutant Control Volume from the ACP is greater than or equal to the Deficit of Stormwater Pollutant Control Volume from the PDP. In other words, the sum of the stormwater pollutant control benefits associated with an ACP must exceed the stormwater pollutant control impacts generated by the PDP[4].

As depicted in **Figure 2-1**, three fundamental steps must be performed to determine whether or not the Permit standard of greater overall water quality benefit has been achieved.

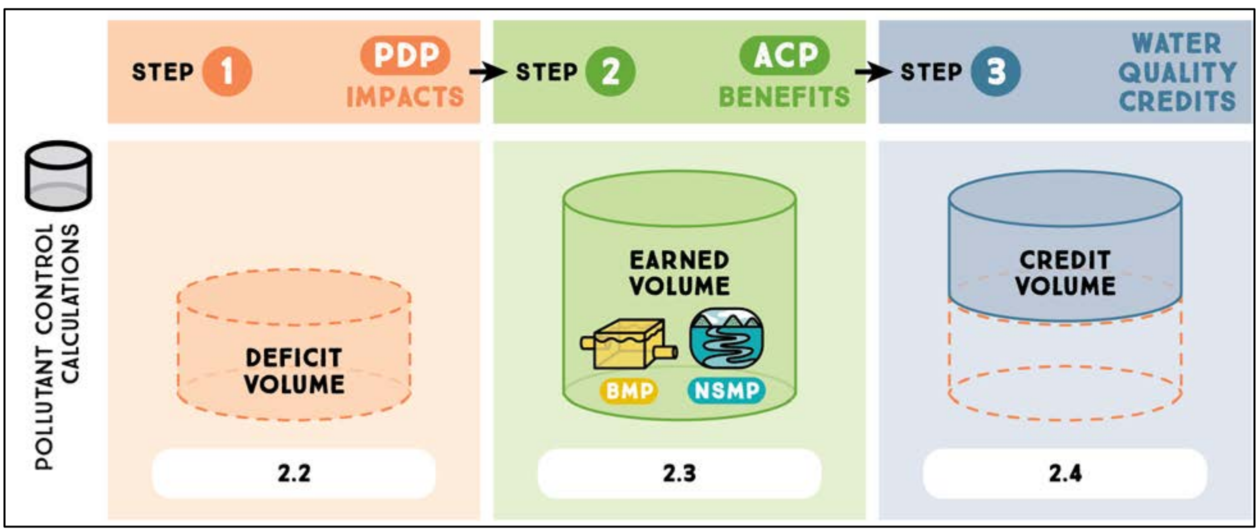

Figure 2-1: WQE Process for Stormwater Pollutant Control

[4] In practice, multiple PDPs could be offset by a single large ACP (i.e., a regional BMP). Conversely, multiple smaller ACPs might offset a single large PDP. Both situations are possible, but the scenario of a single PDP and single ACP is used throughout this guidance for simplicity.

First, the treatment required of and provided by the PDP must be characterized to define the remaining Deficit of Stormwater Pollutant Control Volume. Second, the treatment provided by the ACP is characterized to define the Earned Stormwater Pollutant Control Volume. Finally, the volumes determined from the previous two steps are compared to determine if the Permit standard for pollutant control has been met. Guidelines for conducting each of these steps are provided below in **Sections 2.2** through **2.4.**

2.2 Step 1: PDP Stormwater Pollutant Control Impacts

The first step in the evaluation of water quality equivalency for stormwater pollutant control is to determine the Deficit of Stormwater Pollutant Control Volume associated with a PDP. As illustrated in **Figure 2-2**, this process consists of three tasks: defining the required PDP pollutant control, defining the provided PDP pollutant control, and determining the subsequent Deficit of Stormwater Pollutant Control Volume. Note that this step is not required for applicants constructing Independent ACPs because they are constructed without knowledge of specific PDP impacts.

- Task 1-1: Required PDP Stormwater Pollutant Control. Applicants must first determine the DCV for the PDP. This is the volume that must be treated to meet the structural BMP performance requirements of the Permit. PDP applicants must determine the appropriate DCV per the guidelines set forth in the BMPDM for the jurisdiction implementing the offsite alternative compliance program.

- Task 1-2: Provided PDP Stormwater Pollutant Control. Once the DCV for the project is known, applicants must determine the portion of that volume that is effectively treated through onsite retention, biofiltration, or both. This is also determined per the guidelines set forth in the applicable BMPDM. If a PDP only provides onsite flow-thru treatment, the effectively treated volume is zero.

- Task 1-3: PDP Deficit of Stormwater Pollutant Control Volume. The Deficit of Stormwater Pollutant Control Volume represents the stormwater volume requiring both onsite flow-thru treatment and offsite mitigation. This volume is determined by subtracting the effectively treated stormwater volume from the DCV and is the starting point for determining the overall water quality benefit for stormwater pollutant control (see **Section 2.4)**.

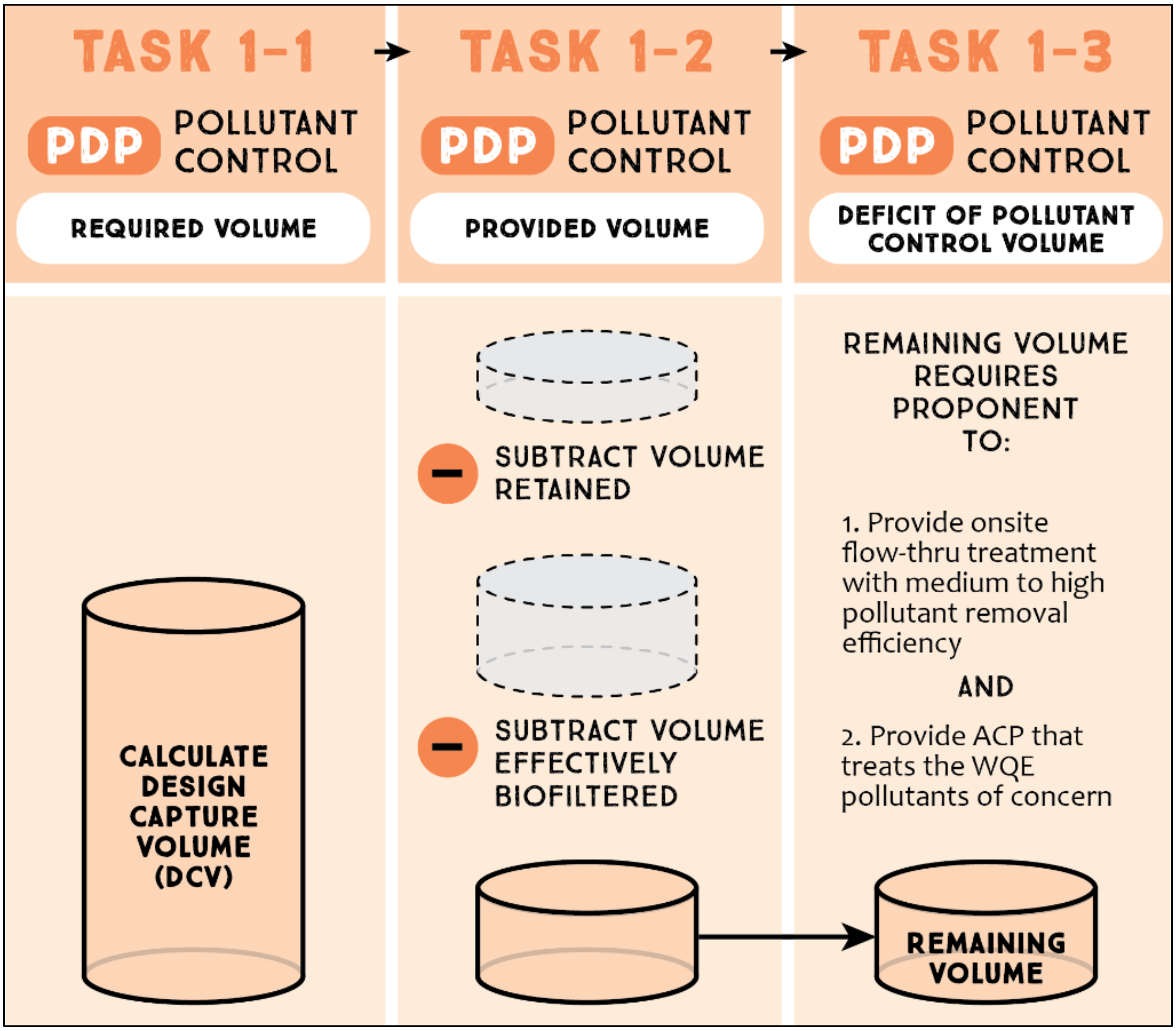

Figure 2-2: PDP Stormwater Pollutant Control Calculations

2.3 Step 2: ACP Stormwater Pollutant Control Benefits

The second step in the evaluation of water quality equivalency for stormwater pollutant control is to determine the stormwater pollutant control benefits provided by an ACP. As illustrated in **Figure 2-3**, this process consists of four tasks: DCV calculations, land use factor calculations, BMP efficacy determination, and determination of Earned Stormwater Pollutant Control Volume.

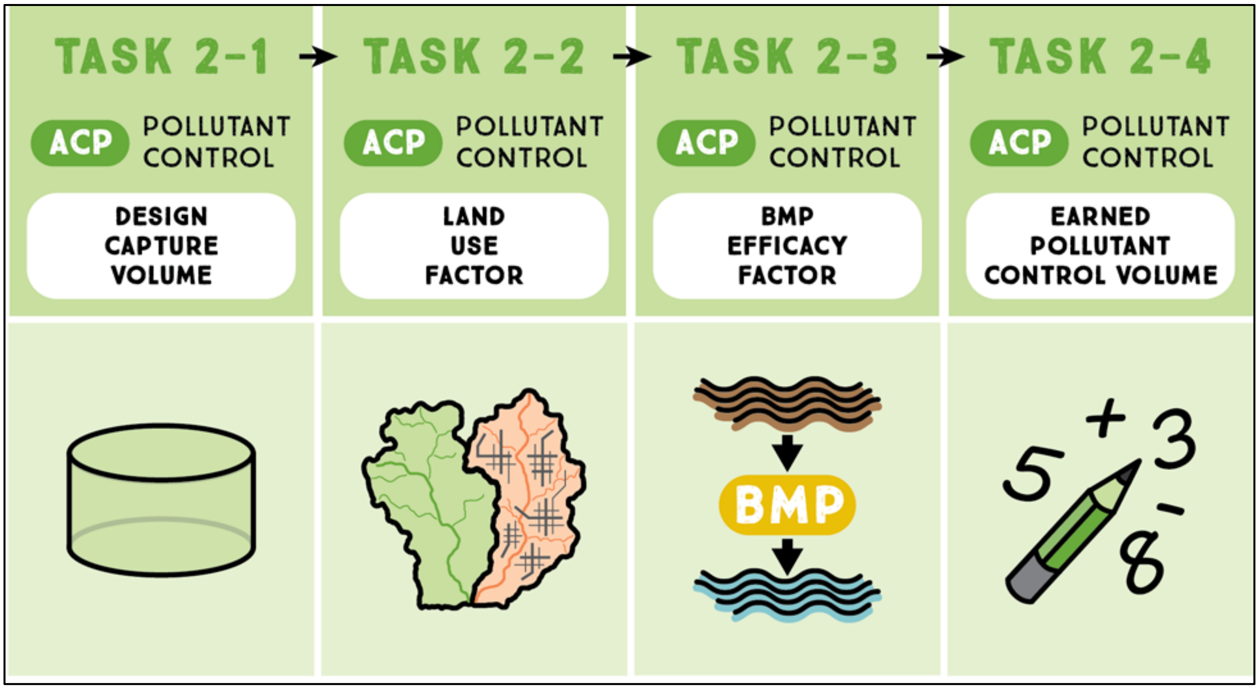

Figure 2-3: ACP Stormwater Pollutant Control Calculations

The Earned Stormwater Pollutant Control Volume (**V_E**) is the volume of water that is effectively treated by the ACP as determined considering the site-specific factors presented in **Equation 2-1**. This volume can be used to offset the Deficit of Stormwater Pollutant Control Volume for PDPs either through Applicant-Implemented ACPs (concurrent proposal of a PDP and ACP) or Independent ACPs (credited for application toward future PDP impacts).

Equation 2-1: Calculation of ACP Earned Stormwater Pollutant Control Volume

$$V_E = L\,(\Delta V + V_2 B_2 - V_1 B_1)$$

Where:

V_E: Earned Stormwater Pollutant Control Volume (ft^3)

L: Land Use Factor

ΔV: Change in Design Capture Volume ($V_1 - V_2$)

V_1: Impacted Condition Design Capture Volume for ACP

V_2: Mitigated Condition Design Capture Volume for ACP

B_1: Impacted Condition BMP Efficacy Factor

B_2: Mitigated Condition BMP Efficacy Factor

Each of the factors considered in determining **V_E** is described below. Although calculation of **V_E** is fundamentally the same for BMPs and NSMPs, project-specific application of **Equation 2-1** differs between the two types of project categories. These differences are described in **Sections 2.3.1** and **2.3.2**.

2.3.1 Option A: ACP Stormwater Pollutant Control Benefits for Structural BMPs

Structural BMPs are a subset of BMPs which detain, retain, filter, remove, or prevent the release of pollutants to surface waters from development projects in perpetuity, after construction of the project is completed. Structural BMPs are addressed according to the following categories:

A Retrofit BMP adds or modifies structural BMPs in areas of existing development where practices do not already exist, are ineffective, or can be significantly enhanced.

A Regional BMP treats stormwater from a tributary consisting of more than one development. Its primary purpose is to improve water quality, protect downstream channels, reduce flooding, or to meet other specific jurisdictional water quality objectives.

A Water Supply BMP captures stormwater and infiltrates, pumps, or otherwise replenishes groundwater, surface water, or other impoundments.

2.3.1.1 Task 2-1: Design Capture Volume ($V_{1,}$ $V_{2,}$ ΔV)

The DCV tributary to the ACP is determined through the same methodology outlined for PDPs in the applicable BMPDM. For application in the stormwater pollutant control water quality equivalency formula, ACP applicants must determine DCV values for both impacted and mitigated ACP conditions and then calculate the difference between the two.

The ACP applicant must first calculate the impacted condition DCV ($\mathbf{V_1}$). The impacted condition DCV is the value corresponding to the ACP site prior to construction of the BMP or improvement. Inclusion of this variable in the WQE formula allows for the effects of any existing BMPs to be factored into the WQE results.

The ACP applicant must also calculate the mitigated condition DCV ($\mathbf{V_2}$). The mitigated condition DCV is the value corresponding to the ACP after construction of the ACP. Inclusion of this variable in the WQE formula allows for the effects of proposed BMPs to be factored into the WQE results.

Finally, the change in DCV (**ΔV**) occurring as a result of ACP implementation must be calculated. This change is determined by subtracting the mitigated condition DCV from the impacted condition DCV (V_1-V_2). Inclusion of this variable in the WQE formula allows for variations in impervious surface area and other low impact development techniques that ultimately affect the calculated DCV to be factored into the WQE results.

Example 2-1: Design Capture Volume Calculations (V_1, V_2, ΔV)

> *An existing 40,000 square foot paved parking lot without pollutant controls is being considered as a potential location for an offsite ACP. The applicant proposes to replace the parking lot pavement in its entirety with pervious concrete. Assuming an 85th percentile rainfall depth of 0.6", a pavement runoff factor of 0.90, and a pervious concrete runoff factor of 0.10, the following volumes may be calculated:*
>
> *The impacted condition DCV (V_1) is 1,800 cubic feet [40,000 x 0.90 x (0.6/12)].*
>
> *The mitigated condition DCV (V_2) is 200 cubic feet [40,000 x 0.10 x (0.6/12)].*
>
> *The change in DCV (ΔV) is 1,600 cubic feet [1,800 – 200].*

2.3.1.2 Task 2-2: Land Use Factor (L)

The land use factor (**L**) is the ratio of pollutant concentrations generated by an ACP tributary compared to the pollutant concentrations generated by a reference tributary[5]. Its purpose is to account for variations in the pollutant concentrations delivered to ACPs and PDPs. This factor is needed because, setting aside other site-specific engineering restrictions and Permit requirements (e.g., to preserve critical coarse sediment yield areas), ACPs may offset PDP impacts from anywhere within the same watershed management area (WMA). WQE calculations must therefore account for variations in tributary land uses and subsequent pollutant concentrations supplied to both projects. To do so, applicants must conduct a number of pollutant and land use specific calculations and then select the land use factor values that are the most conservative (protective) for use in **Equation 2-1**. The process for determining land use factors is shown in **Figure 2-4** and described further below.

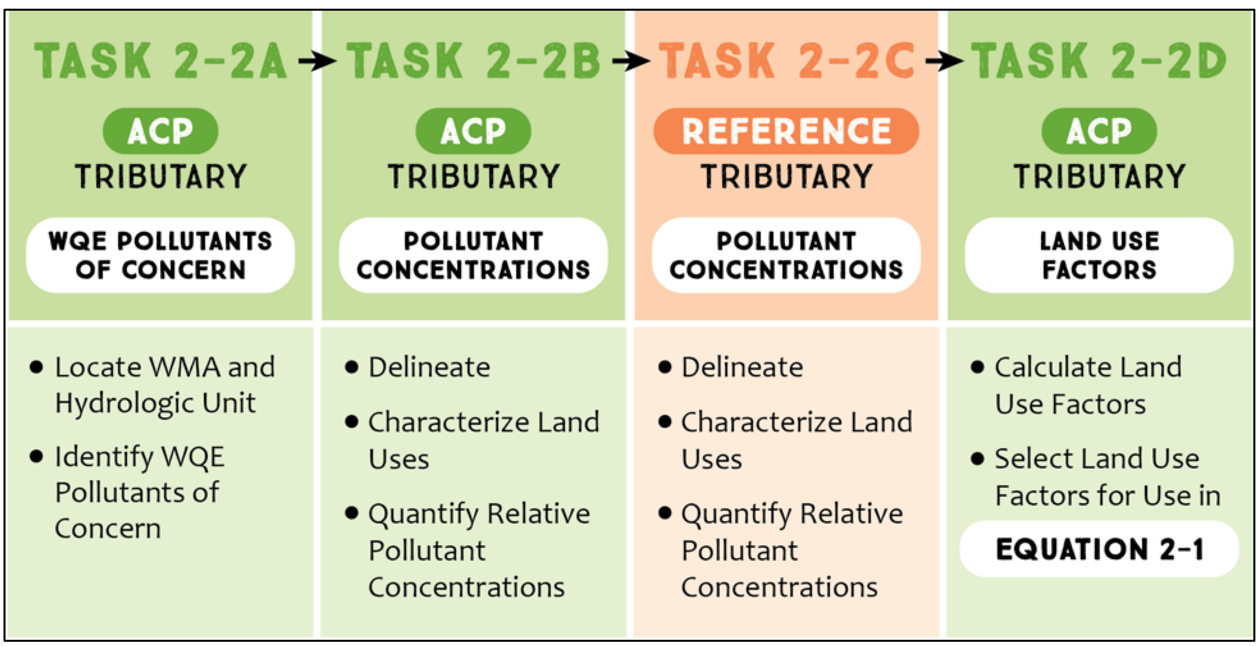

Figure 2-4: Overview of Process for Determining Land Use Factors

[5] *The reference tributary selected for WQE calculations is dependent on whether the project is an Applicant-Implemented or Independent ACP. Guidelines for both scenarios are outlined in subsequent sections.*

Task 2-2a: Identify WQE Pollutants of Concern

To determine the WQE pollutants of concern for an ACP, an applicant must first identify the appropriate WMA and hydrologic unit. A general map is provided in **Figure 2-5** below. WMAs have been established by the Permit and generally correspond with previously mapped hydrologic units; however, this is not always the case. For example, the Permit splits the Penasquitos hydrologic unit into two separate WMAs identified as Penasquitos and Mission Bay. Conversely, the Permit combines Pueblo, Sweetwater, and Otay hydrologic units to form the San Diego Bay WMA. Applicants who cannot clearly distinguish the appropriate WMA and hydrologic unit information from this map may refer to more detailed maps provided in **Appendix D** or may download more detailed shapefiles at www.projectcleanwater.org.

Figure 2-5: Watershed Management Area and Hydrologic Unit Map

Once the applicable WMA and hydrologic unit are determined, applicants must determine the WQE pollutants of concern associated with that area. **Table 2-1** below lists pollutants of concern for each WMA and hydrologic unit subject to the Permit. These generally represent the highest priority pollutants from the WQIPs modified as appropriate to reflect other considerations such as 303(d) listings. **Appendix B** provides additional description and supporting documentation of how these WQE pollutants of concern were selected.

Table 2-1: WQE Pollutants of Concern by Watershed Management Area and Hydrologic Unit

Hydrologic Unit [6]	Watershed Management Area	TSS	TP	TN	TCu	TPb	TZn	FC
San Juan (901.00)	**South Orange County**	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*
Santa Margarita (902.00)	**Santa Margarita River**		X	X				X
San Luis Rey (903.00)	**San Luis Rey**		X	X				X
Carlsbad (904.00)	**Carlsbad**	X	X	X				X
San Dieguito (905.00)	**San Dieguito River**		X	X				X
Penasquitos (906.00)	**Penasquitos**	X	X	X				X
Penasquitos (906.00)	**Mission Bay**	X	X	X				X
San Diego (907.00)	**San Diego River**		X	X				X
Pueblo (908.00)	**San Diego Bay**		X	X	X	X	X	X
Sweetwater (909.00)	**San Diego Bay**		X	X	X			X
Otay (910.00)	**San Diego Bay**	X		X	X			X
Combined (908.00-910.00)	**San Diego Bay**	X	X	X	X	X	X	X
Tijuana (912.00)	**Tijuana River**	X	X	X				X

WMA and hydrologic unit designations also define potential geographic constraints for which an ACP can provide offsetting mitigation for PDP impacts. An ACP may not offset impacts from a PDP that is located in a different WMA. Additional geographic restrictions may also apply to the San Diego Bay WMA, which is subdivided with respect to Pueblo, Sweetwater, and Otay hydrologic units. For example, if an ACP applicant within the San Diego Bay WMA elects to address the WQE pollutants of concern for all three associated hydrologic units, then the ACP may offset PDP impacts from anywhere within the WMA. However, if the ACP applicant elects to only address WQE pollutants of concern within the immediate hydrologic unit, then subsequent ACP benefits may only be used to offset PDP impacts occurring within that hydrologic unit.

[6] *Designations for South Orange County and Santa Margarita Watershed Management Areas will be established upon completion of their respective WQIP processes. To allow potential alternative compliance opportunities within the southern portion of the Santa Margarita River WMA in the interim, pollutants of TP, TN, and FC have been selected based on examination of currently available Watershed Urban Runoff Management Plan and 303(d) listings.*

Task 2-2b: Quantify Relative ACP Pollutant Concentrations

1. Delineate the ACP Tributary

Once the appropriate WMA and hydrologic unit have been determined, the ACP tributary must be delineated per guidelines set forth in the applicable BMPDM. The ACP tributary encompasses all areas that deliver stormwater runoff to the ACP and identifies the boundaries for which land use characterizations must be performed. **Figure 2-6** illustrates an ACP tributary area located within the San Diego River WMA (which in this case is the same as the San Diego Hydrologic Unit).

2. Characterize the ACP Tributary Land Uses

To estimate the pollutant concentrations delivered to an ACP, applicants must characterize and quantify the land uses that are tributary to the ACP in its impacted condition. This is accomplished by overlaying tributary area boundaries with the event mean concentration (**EMC**) land use mapping data provided in **Appendix D**.

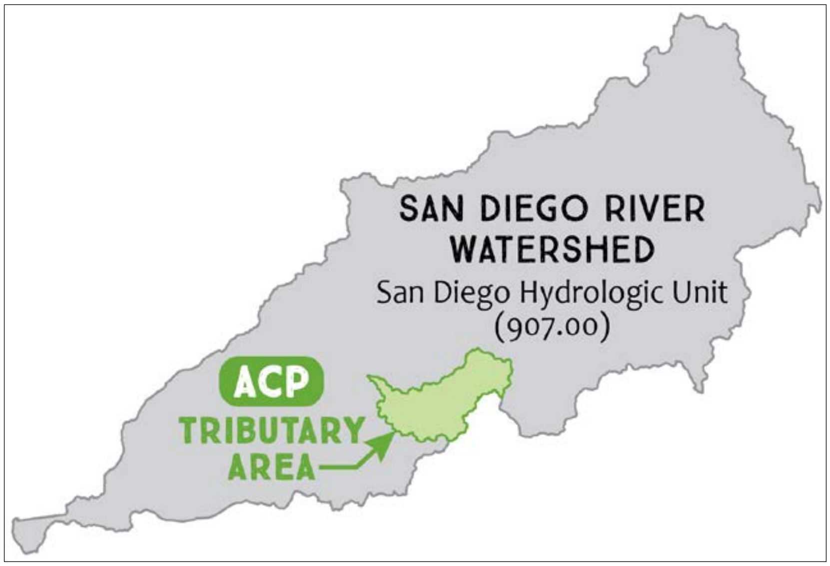

Figure 2-6: Delineation of ACP Tributary Area

The outcome of this overlay is a tabulation of the area of each major land use category within the ACP tributary. For the purposes of this guidance, the following 11 EMC land use categories are utilized: Agriculture | Commercial | Education | Industrial | Multi-Family Residential | Orchard | Rural Residential | Single Family Residential | Transportation | Vacant/Open Space | Water.

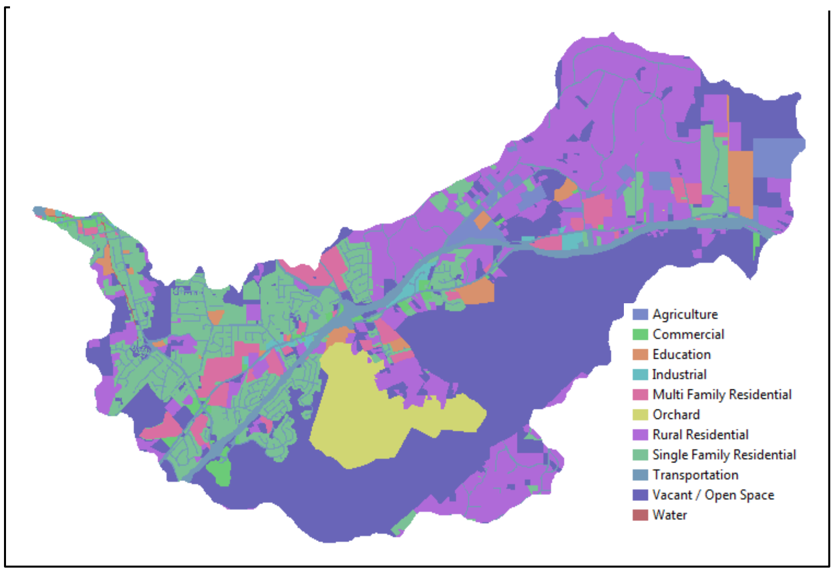

Figure 2-7: Characterization of ACP Tributary Land Uses

Figure 2-7 illustrates the land use composition of the ACP tributary area identified in **Figure 2-6.**

These values will be used below in order to determine relative concentrations for the WQE pollutants of concern. To assist applicants in quantifying the land use composition within specific WMAs and hydrologic units, **Appendix D** contains EMC land use mapping results for the Permit region. These results were developed by correlating 104 San Diego Geographic Information Source (**SANGIS**) and 84 Southern California Association of Governments (**SCAG**) land uses into the appropriate 11 EMC land use categories discussed above. Additional reference information about the development of this mapping is provided in **Appendix B**. At the discretion of individual Copermittees, applicants may be permitted to utilize alternative methods, such as examination of present-day aerial imagery, for characterization of appropriate SANGIS or SCAG detailed land use classifications identified within a tributary. However, in order to maintain consistency amongst land use factor calculations, subsequent correlations of detailed SANGIS or SCAG land use classifications to EMC land use categories must be performed per the correlations presented in **Appendix B, Table B.12**.

3. Quantify Relative Pollutant Concentrations for WQE Pollutants of Concern for ACP Tributary

A relative pollutant concentration for each WQE pollutant of concern must be calculated per **Equation 2-2** below. This equation determines the relative pollutant concentrations generated within an ACP tributary through the use of a methodology that is similar to the process for determining hydrology runoff coefficients. The result is a function of the relative pollutant concentrations and default runoff factors for each land use presented in **Table 2-2** and the land use composition of the ACP tributary.

Applicants may determine relative pollutant concentrations for the ACP tributary through utilization of the template provided in **Worksheet A.5** or the automated spreadsheet calculation tool available on www.projectcleanwater.org.

Equation 2-2: Calculation of Weighted Average Relative Pollutant Concentrations

$$P_1 = \frac{\sum P_{1a}A_aC_a + P_{1b}A_bC_b + \ldots\ldots P_{1k}A_kC_k}{\sum A_aC_a + A_bC_b + \ldots\ldots A_kC_k}$$

Where:

P_1: *Relative Pollutant 1 Concentration for ACP Tributary*

P_{1a} - P_{1k}: *Relative Pollutant 1 Concentration for Land Use a-k respectively (see **Table 2-2**).*

C_a - C_k: *Runoff Factor for Land Use a-k respectively (See **Table 2-2**).*

A_a - A_k: *Area (sf) of Land Use a-k respectively.*

The relative pollutant concentrations presented in **Table 2-2** are derived from EMC data published in the San Diego River and San Luis Rey WQIPs. The original EMC data largely corresponds with default values from the Los Angeles Region Structural BMP Prioritization Tool but has been modified in some instances to better represent values anticipated for the San Diego Region. Additional information for these values is also presented in **Appendix B.1.2.**[7]

[7] *This guidance document assumes that all ACP projects will utilize the relative pollutant concentrations values presented in Table 2-2. It is possible however, that individual Copermittees will allow the use of other data they*

Table 2-2: Relative Pollutant Concentrations and Default Runoff Factors by Land Use

Land Use Category	Default Runoff Factor	(1) TSS	(2) TP	(3) TN	(4) TCu	(5) TPb	(6) TZn	(7) FC
(a) Agriculture	0.10	0.45	1.00	1.00	1.00	1.00	0.59	1.00
(b) Commercial	0.80	0.13	0.16	0.16	0.56	0.48	1.00	0.87
(c) Education	0.50	0.13	0.20	0.11	0.14	0.25	0.39	0.13
(d) Industrial	0.90	0.13	0.19	0.15	0.54	0.68	0.89	0.49
(e) Multi-Family Residential	0.60	0.10	0.13	0.13	0.14	0.15	0.29	0.27
(f) Orchard	0.10	0.18	0.17	0.67	1.00	1.00	0.59	0.11
(g) Rural Residential	0.30	1.00	0.51	0.14	0.10	0.71	0.13	0.19
(h) Single Family Residential	0.40	0.13	0.20	0.15	0.27	0.43	0.35	0.63
(i) Transportation	0.90	0.11	0.26	0.12	0.53	0.31	0.62	0.12
(j) Vacant / Open Space	0.10	0.16	0.10	0.10	0.12	0.10	0.10	0.10
(k) Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The default runoff factors presented in **Table 2-2** have been established by using best professional judgment to assign each land use category a percent impervious value and then determining the weighted average runoff coefficient for the tributary impervious surfaces (C=0.90) and pervious surfaces (C=0.10). Applicants may elect to adjust the default runoff factors provided such adjustments are performed per specifications set forth in the BMPDM and are approved by the applicable Copermittee.

Once the relative concentrations of WQE pollutants of concern being delivered to the ACP for treatment have been quantified, applicants must repeat a similar process for the reference tributary.

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believe to more appropriately quantify pollutant concentrations for the WQE pollutants of concern. In this case, they may elect to substitute other data provided that the following criteria are met: 1) It must be demonstrated that augmented data is in fact more appropriate for use, and 2) Pollutant concentration data must be applied consistently across an entire watershed management area including across jurisdictional boundaries.

Task 2-2c: Reference Tributary Area Calculations

1. Delineate the Reference Tributary

The reference tributary is the area that is used to characterize the land use compositions and subsequent pollutant concentrations that will establish a baseline for comparison to the ACP pollutant concentrations determined in **Task 2-2b**. Differences in pollutant concentrations between the ACP tributary and the reference tributary will determine the land use factor values. As shown in **Figure 2-8**, reference tributaries are determined differently for Applicant-Implemented ACP and Independent ACP.

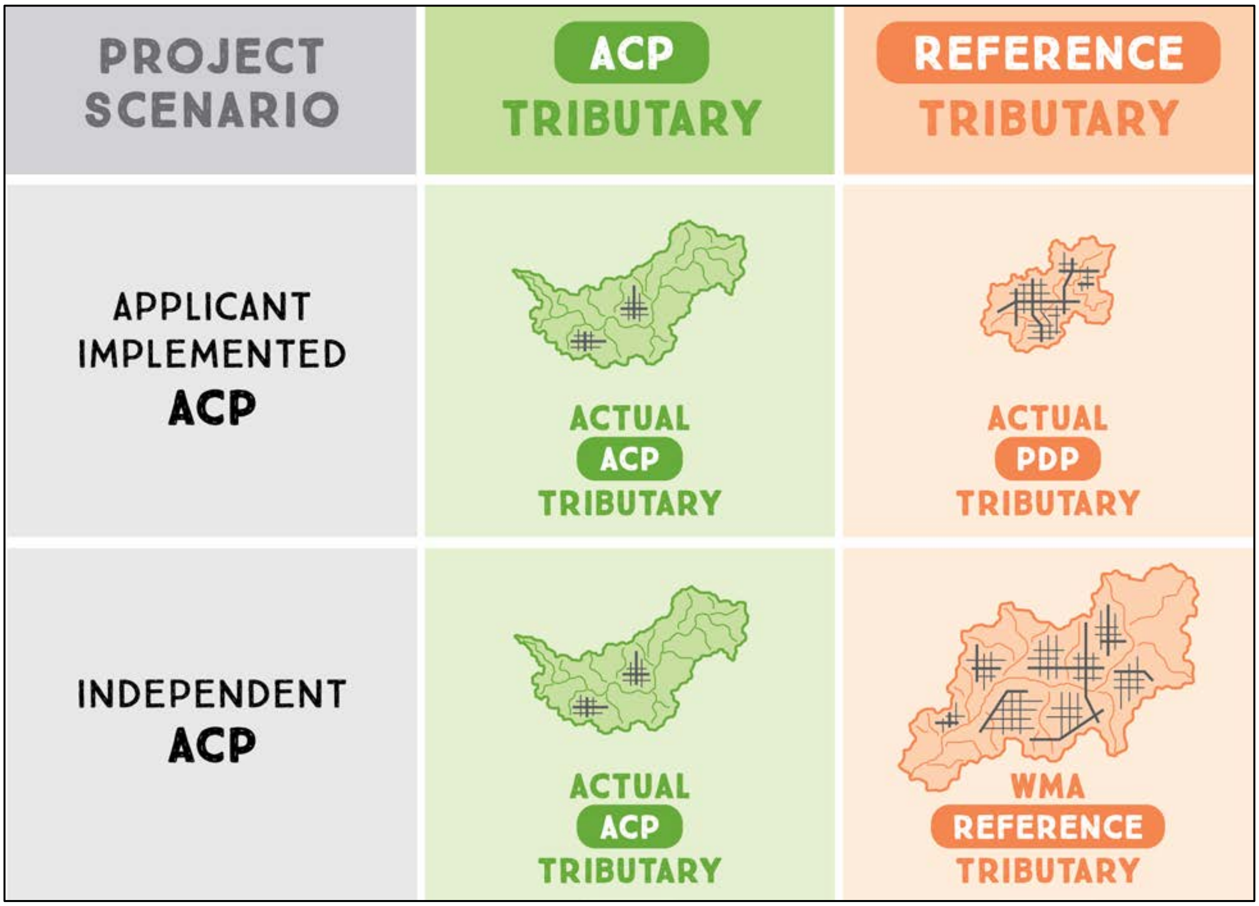

Figure 2-8: Reference Tributary by Project Scenario

For Applicant-Implemented ACPs, the reference tributary is the actual PDP tributary area since this area will have been identified as part of the project application and review process. For Independent ACPs, a PDP will not yet have been identified, so the applicable WMA or hydrologic unit is used as the reference drainage area.

2. Characterize the Reference Tributary Land Uses

The purpose of this sub-task is to characterize the land use composition of the impacted condition reference tributary in order to provide a point of comparison for evaluating the delivery of pollutants to the ACP site. To estimate the pollutant concentrations delivered to the reference tributary, applicants must characterize and quantify the impacted condition land uses within reference tributary by overlaying tributary area boundaries with the EMC land use mapping data provided in **Appendix D**.

The outcome of this overlay is a tabulation of the area of each EMC land use category within the reference tributary. The process of characterizing reference tributary land uses varies for Applicant-Implemented and Independent ACPs is described below.

Applicant-Implemented ACPs must determine the reference tributary land use composition based on examination of the impacted condition of a specific PDP tributary. This may be accomplished using the same process that was performed to characterize the ACP tributary land use composition described in **Task 2-2b**.

For Independent ACPs, applicants must use the values presented in **Table 2-3** below, selecting the reference tributary land use composition values associated with their WMA or hydrologic unit. These values were determined based on a Geographic Information Systems (**GIS**) analysis to determine the composition of EMC land uses that can support a PDP within a respective watershed management area. Additional reference information on this exercise is presented in **Appendix B**.

Table 2-3: Land Use Composition Values (Acres) for Independent ACP Reference Tributaries

Land Use Category	Runoff Factor	Watershed Management Area									
		South Orange County	Santa Margarita River	San Luis Rey	Carlsbad	San Dieguito River	Penasquitos	Mission Bay	San Diego River	San Diego Bay	Tijuana River
Agriculture	0.10	3,926	11,544	12,285	5,483	17,078	718	498	2,816	4,172	6,849
Commercial	0.80	6,121	7,787	876	4,403	1,732	2,043	1,629	4,043	4,837	293
Education	0.50	3,643	1,910	2,923	4,222	1,958	2,492	2,915	5,159	7,418	1,250
Industrial	0.90	2,173	2,522	456	4,887	693	4,270	593	3,660	3960	1,728
Multi-Family Residential	0.60	7,600	1,791	1,460	5,615	963	1,865	2,210	4,979	5,728	811
Orchard	0.10	1,393	16,401	22,963	2,831	3,860	101	0	1,060	113	0
Rural Residential	0.30	2,255	25,341	36,631	10,923	21,741	2,563	13	18,073	21922	20,973
Single Family Residential	0.40	28,130	18,813	7,209	30,211	15,719	12,041	9,117	24,131	35,613	2,410
Transportation	0.90	2,201	1,690	5,575	15,156	6,325	7,114	6,400	13,822	22,642	6,436
Vacant/Open Space	0.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

3. Quantify Relative Pollutant Concentrations for WQE Pollutants of Concern for Reference Tributary

Using the same process performed to quantify relative concentrations for each WQE pollutant of concern for the ACP tributary described in **Task 2-2b,** relative concentrations for each WQE pollutant of concern must be determined for the reference tributary.

Applicants may determine appropriate relative pollutant concentrations for the reference tributary through utilization of the template provided in **Worksheet A.5** or the automated spreadsheet calculation tool available on www.projectcleanwater.org.

Task 2-2d: Land Use Factor Calculation

1. Calculate Land Use Factors for All WQE Pollutants of Concern

The land use factor for each identified WQE pollutant of concern is determined by dividing the relative ACP tributary concentration (**Task 2-2b**) by the relative reference tributary concentration (**Task 2-2c**).

Applicants may determine appropriate land use factors through utilization of the template provided in **Worksheet A.5** or the automated spreadsheet calculation tool available on www.projectcleanwater.org. A graphic representation of **Worksheet A.5** is depicted in **Table 2-4** below.

Table 2-4: Land Use Factor Determination Spreadsheet

Land Use Designation	ACP Tributary Characteristics		Reference Tributary Characteristics		Relative Pollutant Concentrations by Land Use						
	Area (Acres)	Runoff Factor	Area (Acres)	Runoff Factor	TSS	TP	TN	Tcu	TPb	TZn	FC
Agriculture	User Input per Task 2-2b	Use Default Values or Adjust per Task 2-2b	User Input per Task 2-2c	Use Default Values or Adjust per Task 2-2c	0.45	1.00	1.00	1.00	1.00	0.59	1.00
Commercial					0.13	0.16	0.16	0.56	0.48	1.00	0.87
Education					0.13	0.20	0.11	0.14	0.25	0.39	0.13
Industrial					0.13	0.19	0.15	0.54	0.68	0.89	0.49
Multi Family Residential					0.10	0.13	0.13	0.14	0.15	0.29	0.27
Orchard					0.18	0.17	0.67	1.00	1.00	0.59	0.11
Rural Residential					1.00	0.51	0.14	0.10	0.71	0.13	0.19
Single Family Residential					0.13	0.20	0.15	0.27	0.43	0.35	0.63
Transportation					0.11	0.26	0.12	0.53	0.31	0.62	0.12
Vacant / Open Space					0.16	0.10	0.10	0.12	0.10	0.10	0.10
Water					0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		-		-	-	-	-	-	-	-	-
	Relative Pollutant Concentration for ACP Tributary				Calculate for each pollutant per Task 2-2b						
	Relative Pollutant Concentration for Reference Tributary				Calculate for each pollutant per Task 2-2c						
	Watershed Management Area (WMA)				Select appropriate WMA and Hydrologic Unit per Task 2-2a						
	Hydrologic Unit										
	Land Use Factor				Calculate for each WQE pollutant of concern per Task 2-2d						

2. Select Land Use Factor(s) for Use in Equation 2-1

At this point, pollutant-specific land use factors will have been generated for each WQE pollutant of concern. How these factors are subsequently applied to WQE calculations will dependent on the type of BMP that is proposed.

ACPs proposing only retention, biofiltration, or partial retention BMPs will select the lowest land use factor for application into the WQE formula. Selecting the lowest value produces the lowest Earned Stormwater Pollutant Control Volume. This in turn produces the most conservative results, which will ensure the greatest overall water quality benefit. This assumption is only applicable for retention, biofiltration, or partial retention because these BMPs are assumed to perform with comparable efficacy across all pollutants.

ACPs proposing BMPs other than retention, biofiltration, or partial retention BMPs must perform the WQE formula separately for each of the WQE pollutants of concern using the appropriate land use factors and BMP efficacy factors (see **Section 2.3.1.3.1**) for each. The lowest subsequent Earned Stormwater Pollutant Control Volume is then selected. As above, this will conservatively ensure that the greatest overall water quality benefit is provided. Applicants may not simply select the lowest land use factor because future pollutant removal efficacies potentially established for such BMPs will vary with respect to pollutant type.

Example 2-2: Land Use Factor Determination for Applicant-Implemented ACP

An Applicant-Implemented ACP proposes a biofiltration BMP within the San Luis Rey WMA in order to mitigate for a 2-acre commercial PDP that will not provide effective onsite treatment for the entire DCV required by the Permit.

Task 2-2a: *The ACP is located within the San Luis Rey WMA and the San Luis Rey hydrologic unit. The WQE pollutants of concern for the San Luis Rey WMA are: TP, TN, and FC.*

Task 2-2b: *An ACP tributary area of 4 acres is delineated. Overlaying this area with available WQE land use factor maps provided in* ***Appendix D*** *indicates that the ACP tributary is comprised of 1 acre of multi-family residential, 1 acre of rural residential, and 2 acres of commercial land use categories. Populating this information into* ***Worksheet A.5*** *results in the following relative pollutant concentrations for the ACP tributary: TP=0.19, TN=0.16, and FC=0.64.*

Task 2-2c: *Because this is an Applicant-Implemented ACP, the reference tributary must represent a specific PDP tributary. The PDP tributary that this ACP will offset is delineated to be 2 acres in size. Overlaying the reference tributary with available WQE land use factor maps provided in* ***Appendix D*** *indicates that the reference tributary is comprised entirely of commercial land use. Populating this information into* ***Worksheet A.5****, results in the following relative pollutant concentrations for the reference tributary: TP=0.16, TN=0.16, and FC=0.87.*

Task 2-2d: *Per* ***Worksheet A.5****, the following land use factors are determined for the WQE pollutants of concern: TP=1.23, TN=0.94, and FC=0.74. The ACP proposes a biofiltration BMP; therefore, the lowest land use factor (0.74) will be selected for application in the WQE formula.*

(Continued on next page)

Land Use Designation	ACP Tributary Characteristics		Reference Tributary Characteristics		Relative Pollutant Concentrations by Land Use						
	Area (Acres)	Runoff Factor	Area (Acres)	Runoff Factor	TSS	TP	TN	Tcu	TPb	TZn	FC
Agriculture	0.00	0.10	0.00	0.10	0.45	1.00	1.00	1.00	1.00	0.59	1.00
Commercial	2.00	0.80	2.00	0.80	0.13	0.16	0.16	0.56	0.48	1.00	0.87
Education	0.00	0.50	0.00	0.50	0.13	0.20	0.11	0.14	0.25	0.39	0.13
Industrial	0.00	0.90	0.00	0.90	0.13	0.19	0.15	0.54	0.68	0.89	0.49
Multi Family Residential	1.00	0.60	0.00	0.60	0.10	0.13	0.13	0.14	0.15	0.29	0.27
Orchard	0.00	0.10	0.00	0.10	0.18	0.17	0.67	1.00	1.00	0.59	0.11
Rural Residential	1.00	0.30	0.00	0.30	1.00	0.51	0.14	0.10	0.71	0.13	0.19
Single Family Residential	0.00	0.40	0.00	0.40	0.13	0.20	0.15	0.27	0.43	0.35	0.63
Transportation	0.00	0.90	0.00	0.90	0.11	0.26	0.12	0.53	0.31	0.62	0.12
Vacant / Open Space	0.00	0.10	0.00	0.10	0.16	0.10	0.10	0.12	0.10	0.10	0.10
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	4.00	-	2.00	-	-	-	-	-	-	-	-
	Relative Pollutant Concentration for ACP Tributary				0.23	0.19	0.16	0.40	0.43	0.73	0.64
	Relative Pollutant Concentration for Reference Tributary				0.13	0.16	0.16	0.56	0.48	1.00	0.87
	Watershed Management Area				San Luis Rey						
	Hydrologic Unit				San Luis Rey (903.00)						
	Land Use Factor				-	**1.23**	**0.94**	-	-	-	**0.74**

Example 2-3: Land Use Factor Determination for Independent ACP

An Independent ACP proposes a retention BMP within the Tijuana River WMA to generate water quality credits for future sale. The BMP will collect runoff from a 40,000 square foot commercial parking lot.

Task 2-2a: *The ACP is located within the Tijuana River WMA and the Tijuana Hydrologic Unit. The WQE pollutants of concern for the Tijuana River WMA are: TSS, TP, TN, and FC.*

Task 2-2b: *An ACP tributary area of 0.92 acres is delineated. Overlaying this area with available WQE land use factor maps provided in **Appendix D** indicates that the ACP tributary is comprised of a 100% commercial land use category. Populating this information into **Worksheet A.5** results in the following relative pollutant concentrations for the ACP tributary: TSS=0.13, TP=0.16, TN=0.16, and FC=0.87.*

Task 2-2c: *Because this is an Independent ACP, the land use composition for the reference tributary is taken from the values published for the Tijuana River WMA in **Table 2-3** of this document. Populating this information into **Worksheet A.5** results in the following relative pollutant concentrations for the reference tributary: TSS=0.46, TP=0.37, TN=0.17, and FC=0.26.*

Task 2-2d: *Per **Worksheet A.5**, the following land use factors are determined: TSS=0.28, TP=0.44, TN=0.95, and FC=3.32. The ACP proposes a retention BMP; therefore, the lowest land use factor (0.28) will be selected for application into the WQE formula.*

(Continued on next page)

Land Use Designation	ACP Tributary Characteristics		Reference Tributary Characteristics		Relative Pollutant Concentrations by Land Use						
	Area (Acres)	Runoff Factor	Area (Acres)	Runoff Factor	TSS	TP	TN	TCu	TPb	TZn	FC
Agriculture	0.00	0.10	6,849	0.10	0.45	1.00	1.00	1.00	1.00	0.59	1.00
Commercial	0.92	0.80	293	0.80	0.13	0.16	0.16	0.56	0.48	1.00	0.87
Education	0.00	0.50	1,250	0.50	0.13	0.20	0.11	0.14	0.25	0.39	0.13
Industrial	0.00	0.90	1,728	0.90	0.13	0.19	0.15	0.54	0.68	0.89	0.49
Multi Family Residential	0.00	0.60	811	0.60	0.10	0.13	0.13	0.14	0.15	0.29	0.27
Orchard	0.00	0.10	0	0.10	0.18	0.17	0.67	1.00	1.00	0.59	0.11
Rural Residential	0.00	0.30	20,973	0.30	1.00	0.51	0.14	0.10	0.71	0.13	0.19
Single Family Residential	0.00	0.40	2,410	0.40	0.13	0.20	0.15	0.27	0.43	0.35	0.63
Transportation	0.00	0.90	6,436	0.90	0.11	0.26	0.12	0.53	0.31	0.62	0.12
Vacant / Open Space	0.00	0.10	0	0.10	0.16	0.10	0.10	0.12	0.10	0.10	0.10
Water	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.92	-	40,750	-	-	-	-	-	-	-	-
	Relative Pollutant Concentration for ACP Tributary				0.13	0.16	0.16	0.56	0.48	1.00	0.87
	Relative Pollutant Concentration for Reference Tributary				0.46	0.37	0.17	0.35	0.53	0.43	0.26
	Watershed Management Area				Tijuana River						
	Hydrologic Unit				Tijuana (912.00)						
	Land Use Factor				0.28	**0.44**	**0.95**	-	-	-	**3.32**

2.3.1.3 Task 2-3: BMP Efficacy Factor (B)

The BMP efficacy factor (**B**) describes the ability of an ACP to remove pollutants in runoff from the drainage area. This factor is represented as a ratio and can vary from 0.00 to 1.00. A BMP efficacy factor of 1.00 indicates that an ACP provides a pollutant capture efficacy that meets or exceeds typical PDP efficacy standards set forth in the Permit, while a lower BMP efficacy factor value indicates that the ACP provides some fraction of pollutant capture efficacy set forth in the Permit.

The BMP efficacy factor is a function of two variables, the pollutant removal efficiency (**E**), and the provided capture (**C**). Pollutant removal efficiency accounts for variations in the ability of different BMPs to remove pollutants in runoff delivered to an ACP site. The provided capture factor provides a mechanism to quantify the proportional water quality benefits provided by an ACP that does not fully accommodate the sizing criteria set forth by the BMPDM. This section outlines the general methodologies for determining appropriate BMP efficacy factors for various BMP types including: retention BMPs, biofiltration BMPs, partial retention BMPs, treatment train BMPs, and flow-thru BMPs.

In instances where an ACP applicant proposes a single retention BMP, biofiltration BMP, or flow-thru BMP the BMP efficacy factor is determined through application of **Equation 2-3**.

Equation 2-3: BMP Efficacy Factor for Retention, Biofiltration, and Flow-Thru BMPs

$$B = E \times C$$

Where:

B: BMP Efficacy Factor

E: Pollutant Removal Efficiency (**Section 2.3.1.3.1**)

C: Provided Capture (**Section 2.3.1.3.2**)

If an ACP site proposes a single partial retention BMP, the BMP efficacy factor will be determined using **Equation 2-4**, which considers the cumulative effects of retention and biofiltration elements.

Equation 2-4: BMP Efficacy Factor for Partial Retention BMP

$$B = E_r C_r + [(1.0 - E_r C_r) \times E_b C_b]$$

Where:

B: BMP Efficacy Factor

E_r: Retention Pollutant Removal Efficiency (**Section 2.3.1.3.1**)

E_b: Biofiltration Pollutant Removal Efficiency (**Section 2.3.1.3.1**)

C_r: Retention Provided Capture (**Section 2.3.1.3.2.1**)

C_b: Biofiltration Provided Capture (**Section 2.3.1.3.2.2**)

If an ACP proposes a treatment train approach that combines multiple treatment elements into a single BMP, the BMP efficacy factor will be determined through application of **Equation 2-5**, which is a variation of **Equation 2-4** allowing for consideration of additional BMP elements beyond retention and biofiltration. **Equation 2-5** can be expanded to include more than three treatment elements, but this is unlikely in practice. A more likely application is the addition of a flow-thru treatment element at a partial retention basin outlet. The formula allows for consideration of flow-based BMPs, but only those which have met the conditions of **Sections 2.3.1.3.1** and **2.3.1.3.2** below.

Equation 2-5: BMP Efficacy Factor for Treatment Train BMPs

$$B = E_1C_1 + [(1 - E_1C_1) \times E_2C_2] + [(1 - E_1C_1 - E_2C_2) \times E_3C_3]$$

Where:

B: BMP Efficacy Factor

$E_{1,2,3}$: Pollutant Removal Efficiency (1 being most upstream and 3 being most downstream element)

$C_{1,2,3}$: Provided Capture (1 being most upstream and 3 being most downstream element)

<u>Sections 2.3.1.3.1</u> and **<u>2.3.1.3.2</u>** describe the calculation of pollutant removal efficiency (E) and provided capture (C) under various circumstances. **<u>Section 2.3.1.3.3</u>** provides a reference key for the determination of appropriate pollutant removal efficiency and provided capture values for each BMP type and goes on to provide examples of how BMP efficacy factors are calculated for each BMP type.

2.3.1.3.1 Task 2-3a: Pollutant Removal Efficiency (E)

The purpose of the pollutant removal efficiency factor (**E**) is to account for variations in the pollutant removal capabilities of different BMP types. A review of various existing databases including the National Pollutant Removal Performance Database demonstrates that the documented removal efficiencies of various BMP types is too highly variable to reliably establish universally applicable pollutant removal efficiency values by BMP type. While pollutant removal efficiency standards may evolve over time as more data are compiled and additional studies completed, deriving these values directly from applicable Permit language is currently the most direct and reliable method for establishing equivalency. Therefore, this guidance relies on Permit language[8] to define pollutant removal efficiencies as follows:

- <u>Retention BMPs (E = 1.00)</u>: The Permit requires that PDPs implement BMPs designed to retain the pollutants contained within the DCV. Retention BMPs intercept, store, infiltrate, evaporate, or evapotranspire the entire DCV. This implies that retention BMPs provide a pollutant removal efficiency of 100% up to the design capacity of the BMP. By retaining the entire DCV, it can be reasonably concluded that pollutants will not be released through surface runoff or the stormwater conveyance system. Based on this, an overall pollutant removal efficiency value of 1.00 is ascribed to retention BMPs.

- <u>Biofiltration BMPs (E = 0.666)</u>: The Permit allows PDPs to use onsite biofiltration BMPs to treat the portion of the DCV that cannot feasibly be retained onsite. Biofiltration BMPs intercept, store, and biofilter runoff. To meet the onsite performance standards of the Permit through biofiltration alone, biofiltration BMPs must be designed to treat 1.50 times the DCV not retained onsite, or to treat the DCV with a flow-thru design that is capable of holding at least 0.75 times the portion of the DCV not retained onsite. Biofiltration BMPs do not provide retention and ultimately release all intercepted flows via surface runoff or the stormwater conveyance. Since the Permit accepts biofiltration as providing equivalent treatment under the conditions described, a categorical pollutant removal efficiency can be derived for these BMPs. That is, if biofiltration of 1.50 times the DCV is accepted as providing equivalent effective treatment to retention of 1.00 times the DCV, a pollutant removal efficiency value of 0.666 can be inferred. Although efficiencies are normally expected to vary according to pollutant type, this provides an average value that is useful for establishing equivalency.

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[8] *Per Section E.3.c.(1)(a)*

- Partial Retention BMPs: Partial retention BMPs utilize a combination of retention and biofiltration mechanisms to provide stormwater pollutant control benefits. The Permit does not reference pollutant removal efficiencies for partial retention BMPs; however, efficiencies may be established by determining the portions of retention and biofiltration that provide pollutant removal efficiencies of 1.00 and 0.666 respectively.
- Flow-Thru BMPs: Specific pollutant removal efficiencies for flow-thru BMPs are not provided in this guidance; however, should individual parties and/or Copermittees elect to establish such values, processes specified in the BMPDM should be referenced. In any instance where a party proposes to establish removal efficiencies, both of the following conditions must be satisfied:
  - The methodologies used to establish the values must be consistent with all applicable standards and guidelines established in the BMPDM and;
  - The methodologies used to establish the values must be approved by the applicable Copermittee.

  In order to be used in the development of a BMP efficacy factor, pollutant removal efficiencies must be provided for all WQE pollutants of concern within the applicable ACP tributary. Once a pollutant removal efficiency value for a particular BMP is accepted by a Copermittee, it may continue to be accepted for future use provided it is applied consistently with the conditions under which the values were initially obtained.

2.3.1.3.2 Task 2-3b: Provided Capture (C)

The provided capture (**C**) value accounts for the portion of BMPDM pollutant control sizing requirements that are satisfied by an ACP. Incorporation of this value into the WQE formula allows for quantification of the proportional water quality benefits provided by ACPs that do not fully accommodate the sizing criteria set forth by the BMPDM[9]. **Table 2-5** provides a comparison of BMPDM and ACP requirements.

Similar to the determination of pollutant removal efficiencies, methodologies for determining provided capture values vary for differing BMP configurations as described below.

[9] *It is anticipated that other BMPDMs developed under the Permit will incorporate the same standard assumptions. The methods and approaches described here are intended to be adaptable under different sets of assumptions. In such case, however, different Provided Capture Curves than those presented may be required.*

Table 2-5: Comparison of BMPDM vs ACP Requirements

Treatment Type	BMPDM Requirements	ACP Requirements
Retention	PDP retention BMP must retain the entire DCV and provide a drawdown of 36 hours.	ACP retention BMP may retain any portion of the tributary DCV at a drawdown between 6 and 120 hours. Quantifiable benefits may only be applied to what is retained.
Biofiltration	PDP biofiltration BMP must biofilter 1.50 times the DCV that is not retained onsite.	ACP biofiltration BMP may biofilter between 0.00 and 1.50 times the DCV that is not retained by the ACP. Quantifiable benefits may only be applied to what is biofiltered.
Flow-Thru	Flow-Thru BMP must provide flow-thru treatment of medium to high efficacy for the flow rate generated by a 0.2in/hr rainfall event.	Flow-thru BMP may provide flow-thru treatment for between 0.00 and 1.00 times the flow rate generated by a 0.2in/hr rainfall event. Quantifiable benefits may only be applied to what is flow-thru treated.

2.3.1.3.2.1 Task 2-3b - Option 1: Provided Capture for Retention BMPs

As described, retention BMPs provide a pollutant removal efficiency of 1.00 across all pollutants. Therefore, BMP efficacy factors for retention BMPs vary only with respect to the provided capture of the BMP itself. Provided capture values for retention BMPs are a function of the fraction of the DCV retained and the subsequent BMP drawdown time. Provided capture values for retention BMPs must be determined as outlined below.

1. Determine the DCV of the ACP per the applicable BMPDM.
2. Determine the DCV that is retained by the ACP per **Worksheet A.1**.
3. Divide the Step 2 result by the Step 1 result to determine the fraction of the DCV that is retained by the ACP.
4. Determine the drawdown time for the proposed retention BMP per the BMPDM.
5. Utilize the curve presented in **Figure 2-9** to determine the provided capture value as follows:
    a. Identify the fraction of DCV retained (from Step 3) along the x-axis and extend a line vertically up to the intersect with the specified drawdown time (from Step 4).
    b. Extend a line horizontally from this intersect to the y-axis. This will identify the provided capture value (C) for the BMP. Depending on the provided drawdown time of the BMP, stormwater pollutant reduction requirements may be completely satisfied through retention of anywhere between 0.40 times and 1.78 times the DCV.

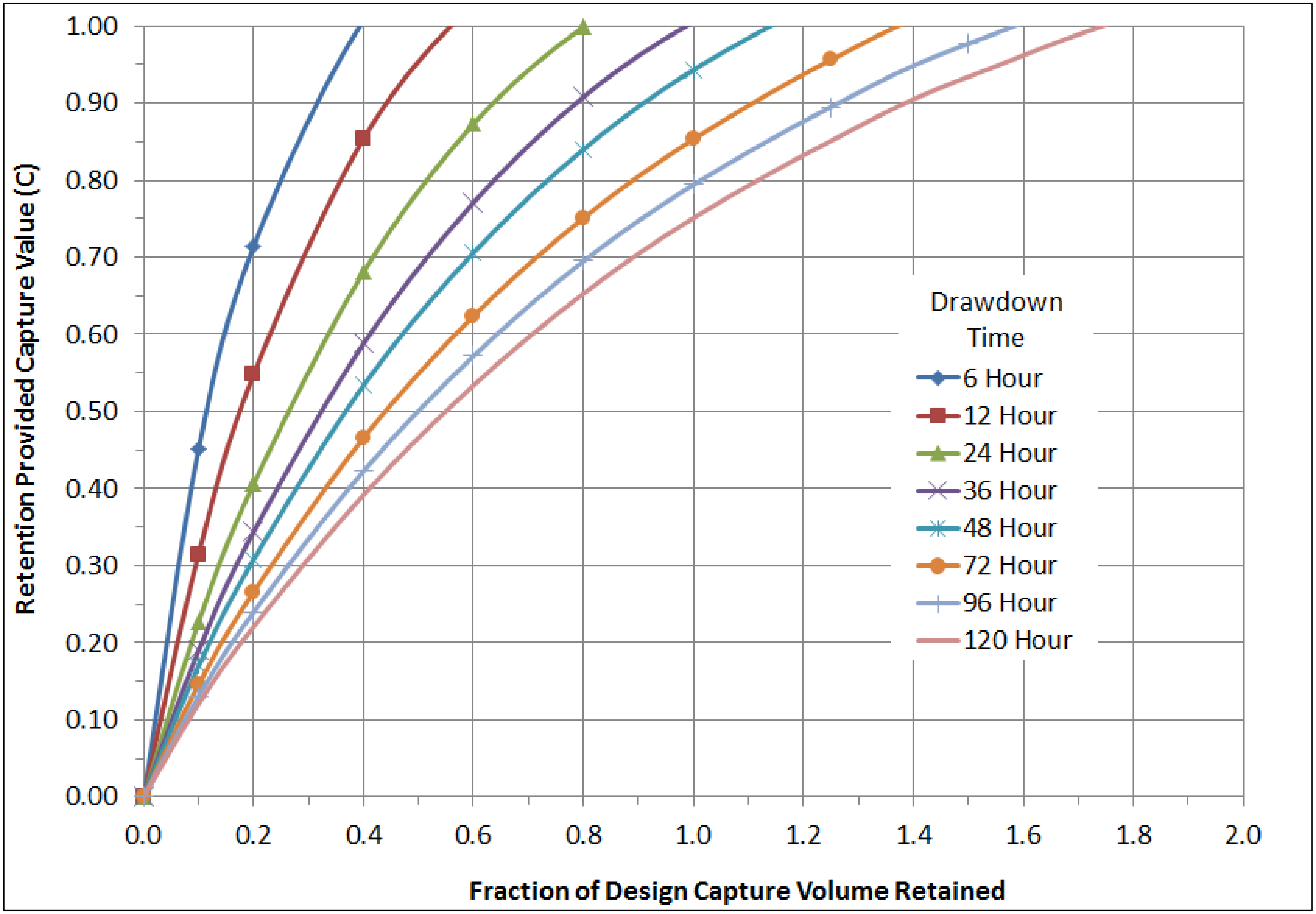

Figure 2-9: Provided Capture Curves for Retention BMPs

2.3.1.3.2.2 Task 2-3b - Option 2: Provided Capture for Biofiltration BMPs

As described, biofiltration BMPs are assumed to provide a pollutant removal efficiency of 0.666 across all pollutants. Therefore, BMP efficacy factors for biofiltration BMPs simply vary with respect to the provided capture of the proposed biofiltration BMP. Provided capture values for biofiltration BMPs are a function of the fraction of DCV biofiltered and do not consider drawdown times. Provided capture values for biofiltration BMPs must be determined as outlined below.

1. Determine the DCV of the ACP per the applicable BMPDM.
2. Determine the DCV that is biofiltered by the ACP per **Worksheet A.2**.
3. Divide the Step 2 result by the Step 1 result to determine the fraction of the DCV that is biofiltered by the ACP.
4. For biofiltration BMPs, the provided capture value is equivalent to the fraction of DCV that is biofiltered (Step 3), with a maximum allowable value of 1.50.

Biofiltration BMPs do not provide retention and ultimately release all intercepted flows via surface runoff or stormwater conveyance. Because many of the BMPs used to satisfy stormwater pollutant reduction requirements rely on surface biofiltration, a retention benefit associated with evapotranspiration is almost always realized even if the BMP is impermeably lined. If an ACP will provide both retention and biofiltration elements to satisfy stormwater pollutant reduction requirements, the applicant should reference the partial retention BMP provided capture methodology outlined in **Section 2.3.1.3.2.3**. However, if the biofiltration BMP does not provide incidental retention or evapotranspiration, as would be the case for a BMP proposing pervious pavement with a subsurface impermeable liner, or if the applicant prefers to utilize a conservative and simplified calculation to determine the BMP provided capture value, the methodology outlined above should be utilized.

2.3.1.3.2.3 Task 2-3b - Option 3: Provided Capture for Partial Retention

In some cases, a BMP may provide stormwater pollutant reductions through a single BMP providing both retention and biofiltration mechanisms. As described in **Section 2.3.1.3.1**, partial retention BMPs provide pollutant removal efficiencies of 1.00 and 0.666 for the respective portions of retention and biofiltration provided. Therefore, BMP efficacy factors for partial retention BMPs vary with respect to the provided capture values for both retention and biofiltration. Provided capture values for partial retention BMPs must be determined as outlined below.

1. Determine the DCV of the ACP per the applicable BMPDM.
2. Determine the DCV that is retained by the ACP per **Worksheet A.3**.
3. Divide the Step 2 result by the Step 1 result to determine the fraction of the DCV that is retained by the ACP.
4. Determine the drawdown time for the proposed retention BMP per the applicable BMPDM.

5. Utilize the curve presented in **Figure 2-9** to determine the provided capture value.
    a. Identify the fraction of DCV retained (from Step 3) along the x-axis and extend a line vertically up to the intersect with the specified drawdown time (from Step 4).
    b. Extend a line horizontally from this intersect to the y-axis. This will provide the provided capture value (C) for the BMP. Depending on the provided drawdown time of a proposed retention BMP, stormwater pollutant reduction requirements may be completely satisfied through retention of anywhere between 0.40 times and 1.78 times the DCV.
6. Determine the equivalent fraction of DCV retained with a 36-hr drawdown.
    a. Prior to moving on to the biofiltration portion of the BMP, the provided capture value must be correlated to the fraction of the DCV retained with a 36 hour drawdown. To do so, the applicant must identify the point on the y-axis identified in Step 5b, extend a line laterally to the intersect with the 36-hour drawdown curve, then extend a line vertically down to the x-axis and read the associated fraction of DCV retained. This value is the equivalent fraction of DCV retained with 36-hour drawdown.
7. Determine the remaining DCV available for biofiltration
    a. The remaining DCV available for biofiltration is calculated as [Step 1 x (1.00 – Step 6a)].
8. Determine the design capture volume that is biofiltered by the ACP per **Worksheet A.3**.
9. Determine the fraction of the design capture volume that is biofiltered by the ACP (Step 8/Step 7).
10. The provided capture value for the biofiltration portion of the BMP is equal to the value determined in Step 9.

2.3.1.3.2.4 Task 2-3b - Option 4: Provided Capture for Flow-thru BMPs

Unlike volume-based retention, biofiltration, and partial retention BMPs, flow-thru BMPs provide stormwater pollutant control benefits associated with a specific flow rate of stormwater rather than a volume of water. Therefore, flow-thru BMPs cannot characterize an appropriate provided capture value through a correlation with DCV. Instead applicants must establish provided capture values with respect to the fraction of the tributary water quality flow rate that is effectively treated by the flow-thru BMP.

ACP tributary water quality flow rates must be determined per flow-thru BMP guidelines set forth in the applicable BMPDM. These flow rates are represented in units of cubic feet per second and are a product of the ACP tributary area in acres, a weighted-average runoff coefficient, and a rainfall intensity of 0.2 in/hr. The flow rate that can be effectively treated by a proposed flow-thru BMP must be the same flow rate that was utilized for third party testing to determine the pollutant removal efficiency discussed in **Section 2.3.1.3.1**. Ultimately, the provided capture value for a flow-thru BMP is determined by dividing the proposed BMP flow rate capacity by the tributary water quality flow rate.[10]

2.3.1.3.2.5 Task 2-3b - Option 5: Provided Capture for Treatment Train BMPs

Treatment train approaches utilize several treatment elements within a single BMP to provide stormwater pollutant control for a single tributary. These methods may potentially provide stormwater pollutant control through any combination of previously discussed BMP types including volume-based BMPs such as bioretention, biofiltration, and partial retention, as well as flow-based BMPs. To determine the provided capture values for each element of the treatment train, applicants should utilize the same fundamental methodologies presented in the sections above with slight modifications necessary to consider the cumulative effects of the treatment train approach. As described further below, these modifications include consideration of the effects of retention in upstream BMP elements and conversion between volume and flow-based BMP elements.

One key consideration in determining provided capture factors for treatment train BMPs is the effect that retention/partial retention elements have on the DCV available to downstream BMP elements. In order to determine appropriate provided capture factors for each element of a treatment train, the volume retained (either through pure retention or the retention portion of partial retention) must be subtracted from the DCV available to downstream BMP elements. For example, if an ACP with a DCV of 1,000 ft^3 retains 500 ft^3 before discharging to a secondary biofiltration area, the biofiltration area will determine the fraction of DCV that is biofiltered with respect to the remaining 500 ft^3 of the initial DCV.

Because treatment train BMPs can include any combination of volume-based and flow-based BMP elements, another key consideration is the potential need to convert an available DCV to an available flow rate and vice versa. ACPs proposing treatment train BMPs that utilize both volume and flow-based BMP elements must calculate the DCV as well as the water quality flow rate associated with their ACP tributary as outlined in the applicable BMPDM. Subsequent provided capture factors for volume-based BMPs will be determined with respect to the fraction of the DCV retained and/or biofiltered. Provided capture factors for flow-based BMP elements will be determined with respect to the fraction of the water quality flow rate that is treated. For example, an ACP with a DCV of 2,125 ft^3 and a water quality flow rate of 0.18 cfs biofilters 1,500 ft^3 of volume before discharging to a secondary flow-thru treatment device capable of treating 0.09 cfs. The fraction of DCV biofiltered is calculated as (1,500/2,125=0.70) while the fraction of water quality flow rate treated is calculated as (0.09/0.18=0.50).

In treatment train scenarios where flow-based BMP elements are located downstream of elements providing stormwater retention, it is necessary to account for the reduced water quality flow rate

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[10] At the discretion of the Copermittee an applicant may elect to produce alternate provided capture curves for flow-thru BMPs that consider the effects of varied rainfall intensity and tributary time of concentration in order to establish a more appropriate non-linear provided capture curve. No such studies are currently available in the San Diego Region, but interested parties may reference Technical Guidance Document Appendices for Orange County (2011).

that is available to the downstream element. This reduction may be accommodated by determining the fraction of initial DCV that was retained. For example, an ACP with a DCV of 2,125 ft^3 and a water quality flow rate of 0.18 cfs retains 600 ft^3 of volume before discharging to a secondary flow-thru treatment device capable of treating 0.09 cfs. The fraction of DCV retained is calculated as (600/2,125=0.28) while the fraction of water quality flow rate treated by the downstream element is calculated as (0.09/0.18x(1.00-0.28))=0.69). A comprehensive example for determination of BMP efficacy factors for treatment train BMPs is provided in **Example 2-8.**

2.3.1.3.3 Summary of BMP Efficacy Factors

As previously discussed, the BMP efficacy factor is a function of two variables, the pollutant removal efficiency (E), and the provided capture (C). **Table 2-6** below references appropriate values and associated report sections specific to determination of these variables with respect to several BMP types. Additionally several examples of BMP efficacy factor determination are provided below.

Table 2-6: Reference Key for Determination of Appropriate BMP Efficacy Factors

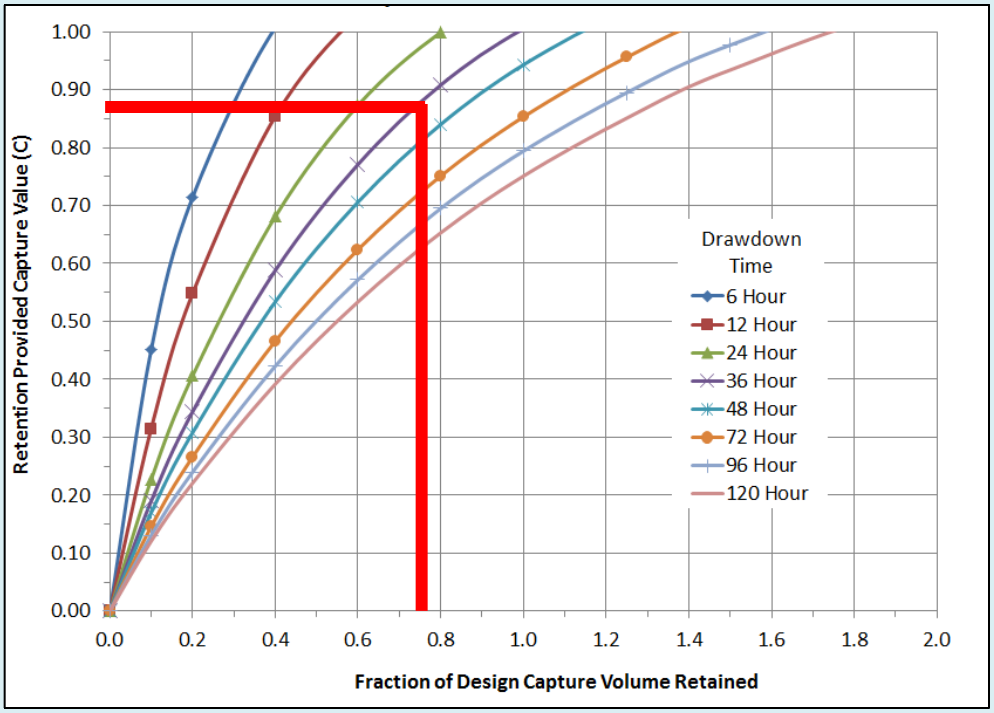
BMP Type	Pollutant Removal Efficiency (E)	Provided Capture (C)
Retention	1.00	See **Section 2.3.1.3.2.1**
Biofiltration	0.666	See **Section 2.3.1.3.2.2**
Partial Retention	1.00 for retention portion 0.666 for biofiltration portion	See **Section 2.3.1.3.2.3**
Flow-Thru	Currently unknown, refer to **Section 2.3.1.3.1** for a framework to establish values.	See **Section 2.3.1.3.2.4**
Treatment Train	Values from rows above	See **Section 2.3.1.3.2.5**

Example 2-4: Determination of BMP Efficacy Factor for a Retention BMP

*Applicants may refer to **Worksheet A.1** for automated calculation of BMP efficacy factors for retention BMPs. For illustration, the process for determination is presented below.*

Provided Capture (C)

1. *The DCV of the ACP is calculated to be 2,000 ft3.*
2. *The proposed ACP BMP retains 1,500 ft^3 per **Worksheet A.1.***
3. *The fraction of the DCV retained is calculated as 0.75. [1,500/2,000]*
4. *The drawdown time for the proposed ACP retention basin is calculated as 36 hours.*
5. *Using **Figure 2-8,** the provided capture value is determined as follows:*
    a. *The value of 0.75 is located along the x-axis and a line is extended vertically up to the intersect with the 36 hour drawdown curve.*
    b. *A line is extended laterally from the point of the drawdown intersect to the y-axis and a Provided Capture Value of 0.87 is determined.*



Pollutant Removal Efficiency (E)

6. *The pollutant removal efficiency (E) for retention BMPs is 1.00.*

BMP Efficacy Factor (B)

7. *The BMP efficacy factor is the product of the pollutant removal efficiency and the provided capture as calculated per **Equation 2-3**.*
   B = 1.00 x 0.87 = 0.87

Example 2-5: Determination of BMP Efficacy Factor for a Biofiltration BMP

*Applicants may refer to **Worksheet A.2** for automated calculation of BMP efficacy factors for biofiltration BMPs. For illustrative purposes, the step by step process for determination is presented below.*

Provided Capture (C)

1. *The DCV of the ACP is calculated to be 2,000 ft^3.*
2. *The proposed ACP BMP biofilters 1,500 ft^3 per **Worksheet A.2.***
3. *The fraction of the DCV biofiltered is calculated as 0.75. [1,500/2,000]*
4. *The Provided Capture value for biofiltration BMPs is equivalent to the fraction of DCV biofiltered (maximum of 1.50). Therefore, the provided capture value is 0.75.*

Pollutant Removal Efficiency (E)

5. *The pollutant removal efficiency (E) for biofiltration BMPs is 0.666.*

BMP Efficacy Factor (B)

6. *The BMP efficacy factor is the product of the pollutant removal efficiency and the provided capture as calculated per **Equation 2-3**.*
   B = 0.666 x 0.75 = 0.50

Example 2-6: Determination of BMP Efficacy Factor for a Partial Retention BMP

*Applicants may refer to **Worksheet A.3** for automated calculation of BMP efficacy factors for partial retention BMPs. The step by step process for determination of BMP efficacy is presented below.*

Provided Capture (C)

1. *The DCV of the ACP is calculated to be 2,000 ft^3.*
2. *The proposed retention BMP retains 1,500 ft^3 per **Worksheet A.3.***
3. *The fraction of the DCV retained is calculated as 0.75. [1,500/2,000]*
4. *The calculated drawdown time for the proposed ACP retention basin in calculated as 48 hours.*
5. *Utilize **Figure 2-8** to determine the provided capture value for the retention portion of the BMP.*
   a. *The value of 0.75 is located along the x-axis and a line is extended vertically up to the intersect with the 48 hour drawdown curve.*
   b. *A line is extended laterally from the point of the drawdown intersect to the y-axis and provided capture Value of 0.80 is determined.*

Determine the equivalent fraction of DCV retained with a 36-hr drawdown.

   a. *Extend a line from the Provided Capture value of 0.80 laterally to the intersect with the 36-hr drawdown curve, then extend a line vertically down to the x-axis to obtain a value of 0.64 for the equivalent fraction of DCV retained with a 36-hr drawdown (dashed line).*

6. *Determine the remaining DCV available for biofiltration.*
   a. *The remaining DCV available for biofiltration is 720 ft^3. [2,000x(1.00-0.64)]*
7. *The design capture volume that is biofiltered is calculated as 1080 ft^3 per **Worksheet A.3**.*
   a. *The provided capture value for the biofiltration portion of the BMP is calculated as 1.50. [1080/720]*

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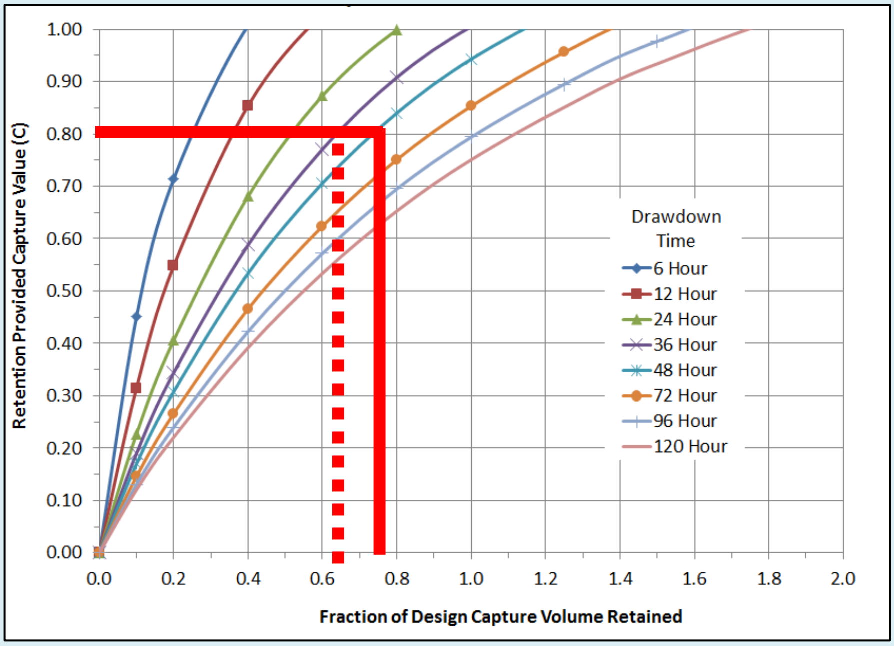

Pollutant Removal Efficiency (E)

8. *The pollutant removal efficiency (E) for biofiltration BMPs is 0.666.*
9. *The pollutant removal efficiency (E) for retention BMPs is 1.00.*

BMP Efficacy Factor (B)

10. *Per* ***Equation 2-4****, the BMP efficacy factor can be calculated as 1.00.* [B = 1.00x0.80 + [(1.00-(1.00x0.80)) x (0.666x1.50) = 0.80 + (0.20 x 1.00) = 1.00

Example 2-7: Determination of BMP Efficacy Factor for a Flow-Thru BMP

An ACP located within the San Diego River watershed management area proposes to retrofit an existing roadway curb inlet with a flow-thru device in order to provide stormwater pollutant control benefit for a 3 acre section of roadway that is entirely impervious. The appropriate BMP efficacy factor is calculated as follows:

Provided Capture (C)

1. *The water quality control flow rate is calculated as 0.60 cfs based on a storm intensity of 0.2in/hr.*
2. *The proposed flow-thru device is determined to treat a maximum flow rate of 0.27 cfs.*
3. *The provided capture value is determined as 0.45.* [0.27/0.60]

Pollutant Removal Efficiency (E)

4. *The pollutant removal efficiency for this flow-thru BMP have been determined via Washington State TAPE and accepted by the applicable Copermittee as:*
   TSS=0.88, TP=0.55, TN=0.43, TCu=0.33, TPb=0.35, TZn=0.37, FC=0.67 (assumed values).

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BMP Efficacy Factor (B)

5. *The BMP efficacy factors are calculated for each WQE pollutant of concern within the San Diego River watershed management area (TP, TN, and FC) per **Equation 2-3** as:*

   $B_{TP} = 0.55 \times 0.45 = 0.25$

   $B_{TN} = 0.43 \times 0.45 = 0.19$

   $B_{FC} = 0.67 \times 0.45 = 0.30$

Note: In a scenario where BMP efficacy factors vary with respect to pollutant type, the Earned Stormwater Pollutant Control Volume presented in **Equation 2-1 must be calculated for each WQE pollutant of concern and the lowest subsequent earned volume will govern.*

Example 2-8: Determination of BMP Efficacy Factor for a Treatment Train BMP

*An ACP located within the San Diego River watershed management area proposes to modify the drainage for a 1 acre section of existing roadway such that stormwater runoff is directed through a sidewalk underdrain fitted with a trash screen and discharged into a partial retention basin with an outlet that has been outfitted with a proprietary media filter. This example will illustrate the application of **Equation 2-5** (which is automated in **Worksheet A.4**) and highlight the complexities introduced into the provided capture value determination when both volume and flow-based BMPs are implemented in a treatment train.*

Provided Capture (C)

1. *The provided capture value for the trash screen must be determined first because it is the most upstream BMP. This is a flow-thru BMP and the provided capture value must be calculated based on the fraction of the water quality flow rate that is treated.*
   a. *The water quality control flow rate for the 1 acre roadway is calculated as 0.18 cfs based on a storm intensity of 0.2 in/hr.*
   b. *The proposed flow-thru device is determined to treat a maximum flow rate of 0.09 cfs.*
   c. *The provided capture value is determined as 0.50.* [0.09/0.18]
2. *The next treatment train element is the partial retention BMP. A partial retention BMP incorporates elements of retention and biofiltration, so provided capture values will be calculated for each of these elements using the methodology outlined in **Section 2.3.1.3.2.3**.*
   a. *The ACP design capture volume for the 1 acre roadway is calculated to be 2,125 ft^3.*
   b. *The proposed retention BMP retains 240 ft^3 per **Worksheet A.3.***
   c. *The fraction of the design capture volume retained is calculated as 0.11.* [240/2,125]
   d. *The calculated drawdown time for the proposed ACP partial retention BMP is calculated as 36 hours.*
   e. *Utilize **Figure 2-8** to determine the provided capture value for the retention portion of the BMP.*
      i. *The value of 0.11 is located along the x-axis and a line is extended vertically up to the intersect with the 36 hour drawdown curve.*
      ii. *A line is extended laterally from the point of the drawdown intersect to the y-axis and provided capture value of 0.21 is determined.*

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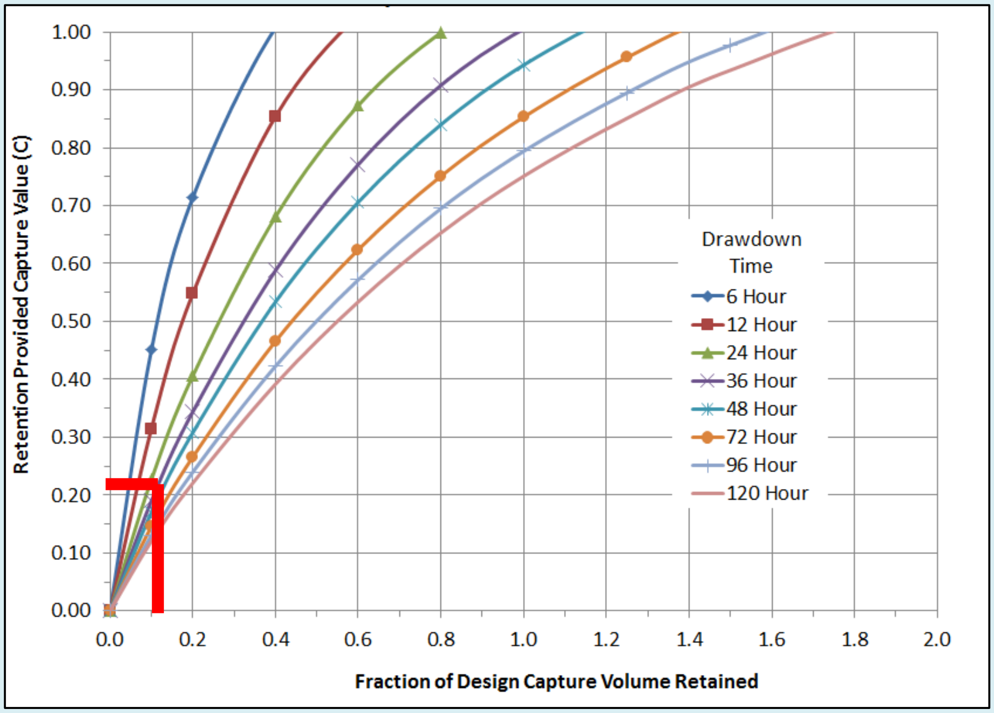

f. *Determine the equivalent* *<u>fraction</u>* *of DCV retained with a 36-hr drawdown.*
   a. *Extend a line from the Provided Capture value of 0.21 laterally to the intersect with the 36-hr drawdown curve, then extend a line vertically down to the x-axis to obtain a value of 0.11 for the equivalent* *<u>fraction</u>* *of DCV retained with a 36-hr drawdown (not applicable in this example due to 36 hr drawdown).*
g. *Determine the remaining DCV available for biofiltration.*
   a. *The remaining DCV available for biofiltration is 1,885 ft*^{3}*.* [2,125x(1.00-0.11)]
h. *The DCV that is biofiltered is calculated as 2,562 ft*^{3} *per* ***<u>Worksheet A.3</u>****.*
i. *The provided capture value for the biofiltration portion of the BMP is calculated as 1.35.* [2,562/1,885]

3. *The last treatment train element is the proprietary media filter. This is a flow-thru BMP that is located downstream of a partial retention BMP, so the provided capture value must be calculated based on the fraction of the* *<u>remaining</u>* *(not previously retained) water quality flow rate that is treated.*
   a. *The original water quality control flow rate for the 1 acre roadway was calculated as 0.18 cfs based on a storm intensity of 0.2in/hr; however, 11% of this flow rate has been removed from flow via the retention portion of the upstream partial retention BMP (Step 2c). Therefore, the applicable water quality flow rate for this device is calculated as 0.18 x (1.00-0.11)=0.16 cfs.*
   b. *The proposed flow-thru device is determined to treat a maximum flow rate of 0.04 cfs.*
   c. *The provided capture value for the proprietary media filter is determined as 0.25.* [0.04/0.16]

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Pollutant Removal Efficiency (E)

4. *The trash screen has been tested per Copermittee approved methodology and the following pollutant removal efficiencies have been established. TSS=0.860, FC=0.000, TN=0.000, TP=0.000, TCu=0.000, TZn=0.000, and TPb=0.000 (assumed values for illustrative purposes only).*
5. *The retention portion of the partial retention BMP provides a pollutant removal efficiency of 1.00 across all pollutants.*
6. *The biofiltration portion of the partial retention BMP provides a pollutant removal efficiency of 0.666 across all pollutants*
7. *The proprietary media filter has been tested per Copermittee approved methodology and the following pollutant removal efficiencies have been established. TSS=0.500, FC=0.230, TN=0.460, TP=0.480, TCu=0.550, TZn=0.670, and TPb=0.580 (assumed values for illustrative purposes only).*

BMP Efficacy Factor (B)

8. *The BMP efficacy factor is calculated for each WQE pollutant of concern within the San Diego River watershed management area (TP, TN, and FC) per* ***Equation 2-5*** *as follows:*
   B_{TP} = 0.00x0.50 + [(1.00-0.00) x (1.00x0.21)] + [(1.00-0.21) x (0.666x1.35)] + [(1.00-0.92) x (0.480x0.25)] = 0.93
   B_{TN} = 0.00x0.50 + [(1.00-0.00)x(1.00x0.21)] + [(1.00-0.21)x(0.666x1.35)] + [(1.00-0.92) x (0.460x0.25)] = 0.93
   B_{FC} = 0.00x0.50 + [(1.00-0.00)x(1.00x0.21)] + [(1.00-0.21)x(0.666x1.35)] + [(1.00-0.92) x (0.230x0.25)] = 0.92

Note: In a scenario where BMP efficacy factors vary with respect to pollutant type, the Earned Stormwater Pollutant Control Volume presented in* ***Equation 2-1* *must be calculated for each WQE pollutant of concern and the lowest subsequent earned volume will govern.*

2.3.1.3.4 Available BMP Efficacy Factor Tools

Applicants may determine appropriate BMP efficacy factors via the methodologies presented above through the use of the calculation templates provided in **Worksheets A.1** through **A.4**, or through use of the automated spreadsheet tool available on www.projectcleanwater.org.

Prior to performing detailed calculations, applicants may choose to examine **Figure 2-10** below to identify BMP efficacy factor values that may be achieved through various combinations of retention and biofiltration treatment elements. Applicants may perform initial level project studies to analyze characteristics such as native infiltration rates and available project footprint, identify subsequent provided capture values, and ultimately identify potential BMP efficacy factors for an ACP. Two simple examples illustrated in the figure are that a biofiltration provided capture value of 1.50, or a retention provided capture factor of 1.00 results in a BMP efficacy factor of 1.00. Another more advanced example is that a partial retention BMP with a retention provided capture factor of 0.50 and a biofiltration provided capture factor of 0.60 results in a BMP efficacy factor of 0.70.

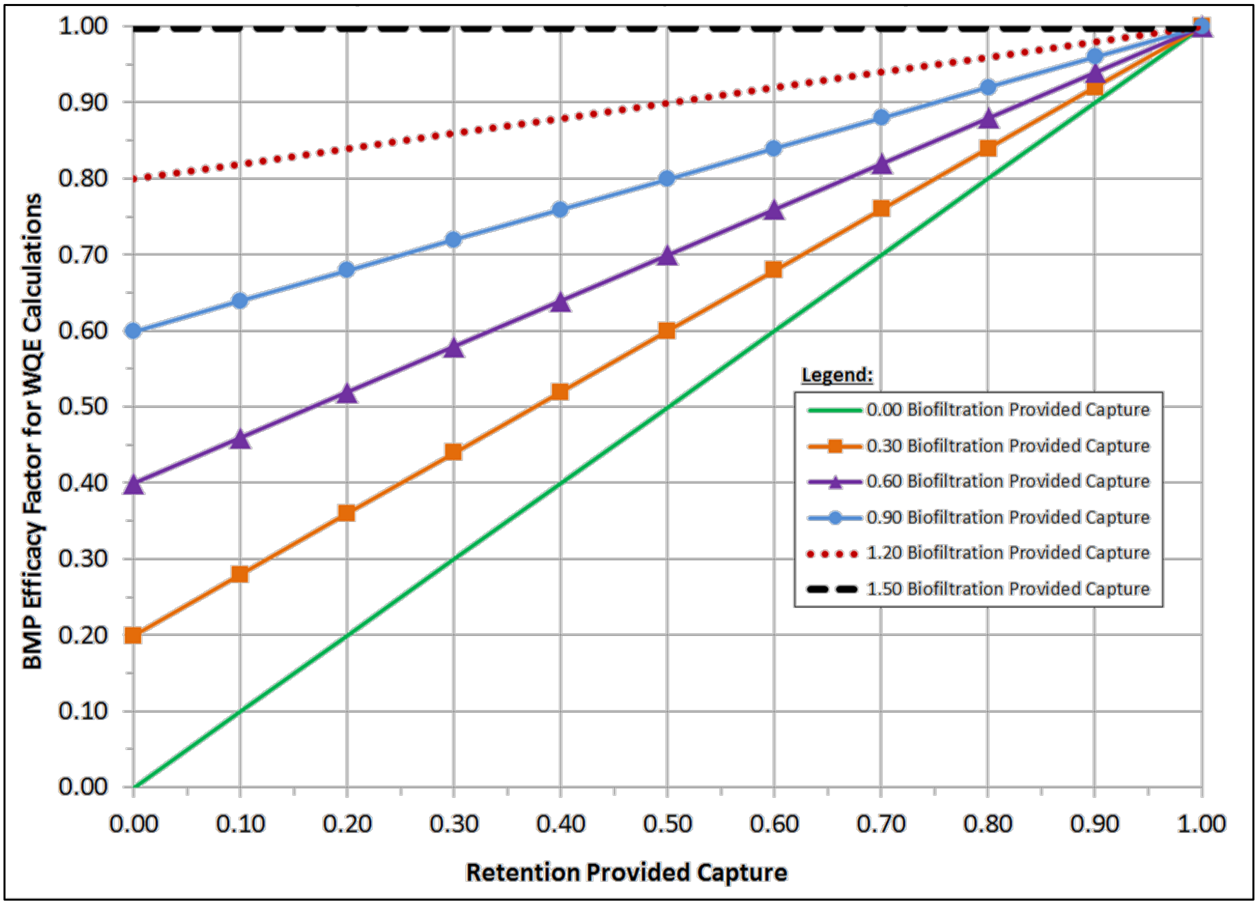

Figure 2-10: BMP Efficacy Factor Initial Planning Tool

2.3.1.4 Task 2-4: Earned Stormwater Pollutant Control Volume (V_E)

The Earned Stormwater Pollutant Control Volume for an ACP is calculated by populating **Equation 2-1** with the appropriate factors determined in **Sections 2.3.1.1** through **2.3.1.3**. A general example of this formula is provided below.

Example 2-9: General Application of WQE Formula for Structural BMPs

An Independent ACP within the Tijuana River WMA removes an existing 40,000 square foot paved parking lot without any pollutant controls and replaces with pervious concrete with the intent of retaining the DCV. As illustrated in ***Example 2-1****, this change in imperviousness at the ACP location reduces the runoff coefficient from a value of 0.90 to 0.10 and subsequently reduces the existing condition DCV from 1,800 cubic feet to 200 cubic feet (V_1=1,800, V_2=200, ΔV=1,600). As illustrated in* ***Example 2-3****, pollutant concentrations generated by the ACP tributary are compared to pollutant concentrations generated by a reference tributary and a land use factor of 0.28 is determined (L=0.28). Per* ***Section 2.3.3****, a proposed BMP efficacy factor of 1.00 is determined (B_2=1.00). The existing ACP site does not have a BMP so the existing condition BMP efficacy factor is 0.0 (B_1=0.00). Therefore, the Earned Stormwater Pollutant Control Volume for this ACP is calculated per* ***Equation 2-1*** *as $V_E = L\ (\Delta V + V_2B_2 - V_1B_1)$ where, V_E = 0.28(1,600 + 200x1.00 - 1800x0.00) = 504 cubic feet.*

2.3.2 Option B: ACP Stormwater Pollutant Control Benefits for Natural System Management Practices

Natural System Management Practices (NSMPs) are practices that are implemented to restore and/or preserve predevelopment watershed functions in lieu of providing direct pollutant removal and hydromodification flow control. NSMPs may include structural/engineered elements, but these elements do not expressly provide stormwater pollutant removal. NSMPs include the following project types.

- **Land Restoration** permanently restores currently developed land back to a stabilized, pre-development condition. Land Restoration may provide quantifiable stormwater pollutant control and hydromodification flow control benefits by restoring the predevelopment stormwater runoff volumes and pollutant concentrations of a tributary.
- **Land Preservation** permanently preserves undeveloped land in its current state. In limited scenarios, Land Preservation may provide quantifiable stormwater pollutant control and hydromodification flow control benefits by preventing increases in stormwater runoff volumes and pollutant concentrations associated with the future built out condition of a tributary.
- **Stream Rehabilitation** restores a stream to a natural, stabilized condition that can accommodate both legacy and future hydromodification impacts. Stream Rehabilitation may provide quantifiable hydromodification flow control benefits through permanent stabilization of streams (see **Section 3.6.1**). In limited scenarios, Stream Rehabilitation may also provide quantifiable stormwater pollutant control benefits by reducing impervious channel surfaces. It is understood that some stream restoration techniques should reduce volumes of runoff through infiltration within streambeds. The techniques for quantifying this volume reduction have not been developed as of yet, nor have the design criteria for stream restoration to achieve additional infiltration. Additionally, pollutant reduction associated with changes in riparian vegetation and stream velocities through stream restoration projects have not been assessed or quantified as part of this effort. For an applicant to obtain pollutant reduction credit associated with volume reduction or other pollutant uptake processes in a stream restoration project, the jurisdiction will be required to develop the methodology to be followed through its own approval processes.

Project applicants proposing land restoration, land preservation, or stream rehabilitation NSMPs should refer to the ACP stormwater pollutant control calculations outlined in **Sections 2.3.2.1** through **2.3.2.4** below. For alternate project categories, applicants should refer to methodologies for Structural BMPs as discussed in **Sections 2.3.1.1** through **2.3.1.4.**

2.3.2.1 Task 2-1: Design Capture Volume (V_1, V_2, ΔV)

ACP applicants proposing land restoration or stream rehabilitation NSMPs may calculate appropriate DCVs by immediately referencing the guidance presented in **Section 2.3.1.1**. ACP applicants proposing Land Preservation practices must ensure that the guidelines below are satisfied before referring to **Section 2.3.1.1** to complete DCV calculations.

- The land being preserved is zoned for development, and
- The land being preserved is physically developable, and
- The development being prevented would not have triggered PDP thresholds for structural BMP performance requirements

Additionally, it should be noted that the concept of impacted versus mitigated conditions is fundamentally different for land preservation practices. For structural BMPs, the impacted condition design capture volume (V_1) represents the existing condition of the ACP tributary that will be improved through construction of an ACP. Conversely, for land preservation practices, the impacted condition design capture volume (V_1) represents the future condition of the ACP tributary that would occur if built out in accordance to existing zoning designations. Therefore, the impacted condition design capture volume for land preservation practices must be calculated with respect to the future surface characteristics that are anticipated for the zoned land use.

For Structural BMPs, the mitigated condition design capture volume represents the proposed condition of the ACP tributary that is created through construction of an ACP. Conversely, for land preservation practices, the mitigated condition design capture volume (V_2) represents the existing condition of the ACP tributary that will be preserved through land preservation practices.

Example 2-10: DCV for Land Preservation Natural System Management Practice

*An applicant seeking to generate stormwater pollutant control benefits purchases an existing 9,995 square foot undeveloped parcel that is zoned for future commercial development. The parcel does not receive stormwater runoff from adjacent developed areas, so the applicant elects to generate stormwater pollutant control benefits through preservation of the land rather than through construction of a structural BMP. Based on examination of zoning maps, the purchased parcel is approved for commercial land use and is anticipated to be entirely impervious in its developed condition. Because the parcel is 9,995 square feet, which is below the PDP threshold for commercial development, it is determined that the future commercial development would not be developed to PDP standards. Assuming an 85th percentile rainfall depth of 0.6", a pavement runoff factor of 0.90, and a landscape runoff factor of 0.10, the following volumes may be calculated for inclusion in **Equation 2-1**.*

The impacted condition DCV (V_1) is calculated as 450 cubic feet [9,995 x 0.90 x (0.6/12)].

The mitigated condition DCV (V_2) is calculated as 50 cubic feet [9,995 x 0.10 x (0.6/12)].

The change in DCV (ΔV) is calculated as 400 cubic feet [450 – 50].

2.3.2.2 Task 2-2: Land User Factor (L)

The methodology for determining land use factors for NSMPs does not vary from the methods presented for Structural BMPs. All NSMP Applicants should follow the land use factor guidance set forth in **Section 2.3.1.2.**

2.3.2.3 Task 2-3: BMP Efficacy Factor (B)

NSMPs are implemented to restore or preserve predevelopment watershed functions in lieu of providing direct pollutant removal and hydromodification flow control. NSMPs may include structural or engineered elements, but these elements do not expressly provide stormwater pollutant control benefits. Therefore, for NSMPs the mitigated condition BMP efficacy factor (B_2) may never be greater than the impacted condition BMP efficacy factor (B_1).

2.3.2.4 Task 2-4: Earned Stormwater Pollutant Control Volume (V_E)

The Earned Stormwater Pollutant Control Volume for an ACP is calculated by populating **Equation 2-1** with the appropriate factors determined in **Sections 2.3.2.1** through **2.3.2.3**. A general example of this formula is provided below.

Example 2-11: General Application of WQE Formula for NSMPs

*An Independent ACP applicant seeking to generate stormwater pollutant control benefits in the Tijuana River WMA purchases an existing 9,995 square foot undeveloped parcel that is zoned for future commercial development. The parcel does not receive stormwater runoff from the adjacent developed areas, so the applicant elects to generate stormwater pollutant control benefits through preservation of the land rather than through construction of a structural BMP. Based on examination of zoning maps, the purchased parcel is approved for commercial land use and is anticipated to be entirely impervious in its developed condition. As illustrated in **Example 2-10**, this would prevent 9,995 square feet of impervious area from being developed and generate the following DCVs (V_1=450, V_2=50, ΔV=400). As illustrated in **Example 2-3**, pollutant concentrations generated by the ACP tributary are compared to pollutant concentrations generated by a reference tributary and a land use factor of 0.28 is determined (L=0.28). Finally, the existing ACP site does not have a BMP so the impacted condition BMP efficacy factor is zero (B_1=0.00), and since this is a NSMP, the mitigated condition BMP efficacy factor is also zero (B_2=0.00). Therefore, the Earned Stormwater Pollutant Control Volume for this ACP is calculated per **Equation 2-1** as $V_E = L\,(\Delta V + V_2B_2 - V_1B_1)$ where, $V_E = 0.28(400 + 50\text{x}0.00 - 450\text{x}0.00) = 112$ cubic feet.*

2.4 Step 3: Determination of Stormwater Pollutant Control Credits

Greater overall water quality benefit for stormwater pollutant control may be established through participation in an offsite alternative compliance program by demonstrating that the Earned Stormwater Pollutant Control Volume from the ACP is greater than or equal to the Deficit of Stormwater Pollutant Control Volume from a PDP. This demonstration is made by simply subtracting the volume determined in **Step 2** by the volume determined in **Step 1** and ensuring the result is greater than or equal to zero.

Example 2-12: Demonstration of Greater Overall Water Quality Benefit

Scenario 1:

Step 1) A PDP determines that is has a 1,000 cubic foot Deficit of Stormwater Pollutant Control Volume.

Step 2) An ACP calculates an Earned Stormwater Pollutant Control Volume of 800 cubic feet.

Step 3) The ACP pollutant control benefits do not offset the PDP pollutant control impacts (800 - 1,000 = -200). Potential solutions to address this issue include: providing multiple ACPs, enlarging or otherwise making the proposed ACP more effective, and/or reducing the PDP Deficit of Stormwater Pollutant Control Volume through onsite measures.

Scenario 2:

Step 1) A PDP determines that is has a 1,000 cubic foot Deficit of Stormwater Pollutant Control Volume.

Step 2) An ACP calculates an Earned Stormwater Pollutant Control Volume of 1,000 cubic feet.

Step 3) The ACP pollutant control benefits completely offset the PDP pollutant control impacts without any excess credit (1,000 – 1,000 = 0).

Scenario 3:

Step 1) A PDP determines that is has a 1,000 cubic foot Deficit of Stormwater Pollutant Control Volume.

Step 2) An ACP calculates an Earned Stormwater Pollutant Control Volume of 1,200 cubic feet.

Step 3) The ACP pollutant control benefits more than offset the PDP pollutant control impacts (1,200 – 1,000 = 200). A Stormwater Pollutant Control Volume Credit of 200 cubic feet may be banked, but cannot be traded to another party until a credit system has been developed.

3. WATER QUALITY EQUIVALENCY CALCULATIONS FOR HYDROMODIFICATION FLOW CONTROL

The hydromodification management requirements for PDPs set forth in Section E.3.c.(2) of the Permit include two components: flow control for post-project runoff from the project site, and protection of critical coarse sediment yield areas. The flow control requirements of Section E.3.c.(2)(a) require that PDPs must implement onsite BMPs to manage hydromodification such that post-project runoff conditions (flow rates and durations) do not exceed pre-development runoff conditions by more than 10 percent for the range of flows that result in increased potential for erosion or degraded instream habitat downstream of the PDP. The critical sediment yield area protection requirements of Section E.3.c.(2)(b) require that PDPs must avoid critical sediment yield areas that are known to the Copermittees or are identified in the WMAA, or implement measures that allow critical coarse sediment to be discharged to receiving waters, such that there is no net impact to the receiving water. If a jurisdiction has an offsite alternative compliance program in place, a PDP may elect to address all hydromodification management flow control requirements of Section E.3.c.(2)(a) through an offsite alternative compliance project. However offsite alternative compliance is not an option to meet the critical sediment yield area protection requirements of Section E.3.c.(2)(b) (the Permit does not provide this option). Protection of critical coarse sediment yield areas is generally a land planning practice, in which disturbance of these areas should be avoided in the site design.

Flow control for post-project runoff from a PDP is generally achieved through implementation of structural BMPs for flow control, including retention, biofiltration, and/or detention BMPs (herein "flow control facilities"). At times it may be difficult or infeasible for a PDP to implement flow control facilities to meet the hydromodification management flow control requirements onsite. For example, if a PDP adjacent to existing development must discharge runoff at surface level to existing streets because there are no underground storm drain systems to connect to, and runoff cannot be infiltrated at the PDP site due to poor soils or other constraints, then providing flow control for impervious driveways, parking areas, or other surface level features may be difficult or infeasible, because structural BMPs collecting and storing runoff from the surface would require a pump to lift runoff from subsurface storage features back to the surface. It may be preferable to use an ACP to provide mitigation offsite.

As depicted in **Figure 3-1** on the following page, three fundamental steps must be performed to determine whether an offsite alternative compliance project satisfies the permit standard for demonstrating greater overall water quality benefit for hydromodification flow control has been achieved.

First, the applicant must characterize the PDP's Deficit of Total Impervious Area Effectively Managed and identify any ACP location requirements associated with the PDP project type. Second, the applicant must characterize the ACP's Earned Directly Connected Impervious Area Effectively Managed and ensure the proposed ACP satisfies the location requirements associated with the PDP project type. Finally, the areas determined from the previous two steps are compared to determine if the Permit standard for hydromodification flow control has been met.

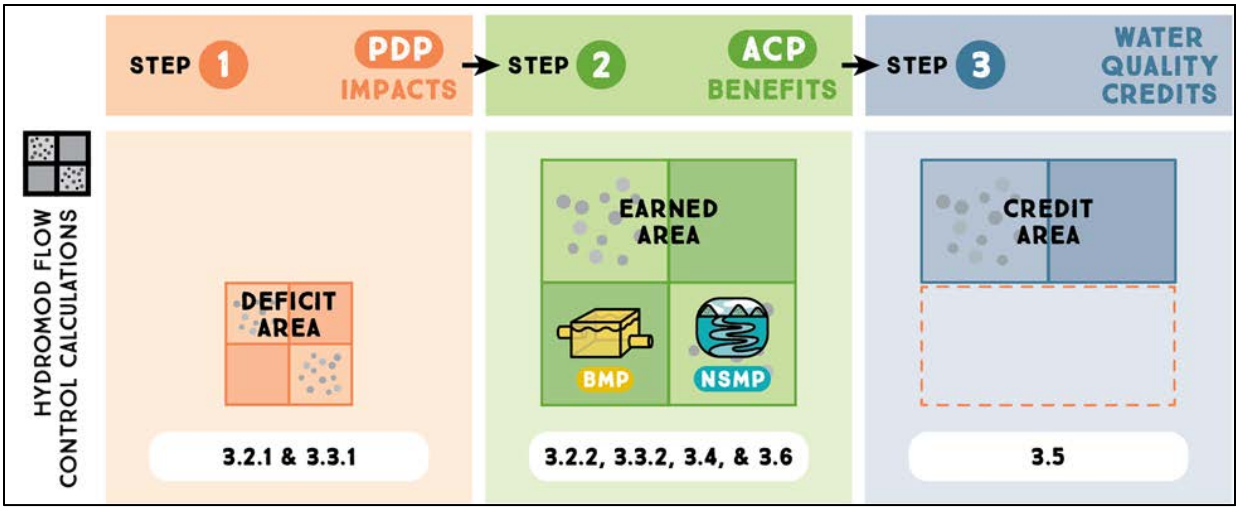

Figure 3-1: WQE Process for Hydromodification Flow Control

3.1 Overview of Hydromodification Flow Control Equivalency Calculations

The hydromodification flow control equivalency guidance provided in this document will allow for offsite alternative compliance projects such as retrofit BMPs, regional BMPs, water supply BMPs, land restoration NSMPs, land preservation NSMPs, and stream rehabilitation NSMPs to provide quantifiable hydromodification management flow control benefits that can be used to offset impacts associated with a PDP. There are however significant limitations on the locations of projects that can generate such benefits. These limitations will be discussed in more detail in **Section 3.3**, but they require PDPs that are generating a net increase in impervious surfaces to provide hydromodification management mitigation at a location at or upstream of the point of discharge to the susceptible stream. However, in some instances such as a PDP that does not increase impervious surfaces, the hydromodification flow control ACP may be constructed anywhere within the watershed management area that is not HMP exempt.

This guidance document will discuss flow control facilities as ACPs. A flow control facility may be any type of structural BMP that provides runoff storage volume and provides flow control for runoff that is discharged rather than infiltrated (up to the upper threshold of the range of flows to control for HMP mitigation). This guidance document describes the hydromodification flow control equivalency currency, and specific rules to apply the currency. A flow control facility may be either an applicant-implemented ACP or an independent ACP.

The user of this guidance document is assumed to be familiar with both the "Final Hydromodification Management Plan Prepared for County of San Diego, California," dated March 2011, (herein "Final HMP"), and the "Model BMP Design Manual San Diego Region," dated June 2015 (herein "BMPDM"). The Final HMP describes the development of performance standards for control of hydromodification in San Diego County, and provides important information about the concepts behind the performance standards. The BMPDM presents the performance standards updated to meet 2013 MS4 Permit requirements, and provides guidelines and parameters for design of flow control facilities to meet the performance standards. To design either an applicant-implemented ACP or an independent ACP, the BMPDM must be consulted (this guidance document is not a substitute for the BMPDM or the Final HMP). Design of a flow control facility for hydromodification management is based on continuous simulation hydrologic modeling and includes determining both a critical channel flow rate specific to the receiving channel (lower threshold of the range of flows to control for HMP mitigation) and a storage volume, and demonstrating that peak flow rates and durations are controlled within the range from the critical channel flow rate to the upper threshold of the range of flows to control for HMP mitigation.

3.2 Hydromodification Flow Control Equivalency Currency

The hydromodification flow control equivalency currency is directly connected impervious area (DCIA) effectively managed (e.g., mitigated by a flow control facility). DCIA (also known as effective impervious area or EIA) is impervious area directly connected to streams by urban drainage systems. This includes impervious area conveyed directly into urban drainage systems such as a street draining to storm drain inlets; and for the purpose of this hydromodification flow control equivalency currency, DCIA also includes impervious area where runoff subsequently conveyed across a pervious area within a developed environment occurs as concentrated shallow flow (such as flow from a rooftop conveyed in a swale) and then into an urban drainage system. DCIA directly affects the volume of runoff delivered to a stream. DCIA has also been identified as a strong predictor of stream ecological condition by several studies (Walsh et. al., 2005).

Hydromodification flow control equivalency currency (DCIA effectively managed) is different from water quality equivalency currency (volume) for several reasons:

- Hydromodification flow control for post-project runoff must be defined as both flow rate (Q) and volume. Transferring and potentially splitting or otherwise distributing the volume is problematic because the specific critical channel flow rate that the volume is associated to must be maintained. Volume alone without proper flow control will not provide HMP mitigation. Note this also means there is no partial hydromodification flow control equivalency currency generated by a facility that provides volume but releases runoff to downstream systems susceptible to erosion without hydromodification flow control.

- Required HMP volume to achieve flow control compliance for a PDP depends on the type of flow control facility implemented. It is determined based on the flow control facility's performance in a continuous simulation model and can vary based on the components proposed for the flow control facility and the engineer's ability to optimize the model, unlike the DCV for pollutant control, which is a straightforward calculation of the 85^{th} percentile runoff generated from the PDP.

- There are several available hydrologic models that can perform continuous simulation analyses to calculate the HMP Q and volume required for a flow control facility, with varying results. Parameters and procedures for these models are continually subject to change and improvement, and the state of practice for hydromodification flow control facility design is evolving. Currently, the variability of the model results is problematic for trading HMP Q and volume from one project to another.

- Because stormwater pollutants are not a factor in hydromodification flow control equivalency, land use within a PDP or within an ACP drainage area can be simplified to differentiate only impervious vs. pervious lands without detailed accounting of pollutant generating activities occurring on developed lands. There is no land use factor necessary in the hydromodification flow control equivalency calculation that would correlate to the land use factor that adjusts volume in the water quality equivalency calculation.

For the reasons listed above, volume was not selected as the hydromodification flow control equivalency currency. The currency has been simplified to DCIA effectively managed. DCIA is a measurable physical feature of a PDP and an ACP drainage area that is not subject to model uncertainty.

The basis of the hydromodification flow control equivalency currency is that mitigating one directly connected impervious acre is as valuable as mitigating another directly connected impervious acre, as long as strict requirements for the location of the ACP relative to the PDP are met. All impervious surfaces are assumed to generate the same runoff volume. It will be assumed that variability of pre-development runoff from PDPs across different soil types and slopes need not be considered because (1) PDPs seeking to use alternative compliance for HMP mitigation are likely to all be in similar areas of poor soils with little to no infiltration, and (2) the variability from nuances of slope and underlying soil type may be less than the currently accepted variability between models used for flow control facility design in San Diego.

Measuring currency in terms of DCIA effectively managed will allow for modeling parameters and procedures to be updated without requiring parallel updates to the hydromodification flow control equivalency calculation methods. Changes to modeling parameters and procedures shall not invalidate Earned DCIA Effectively Managed generated by an ACP that met the BMPDM requirements that were in effect at the time of the ACP development permit application.

3.2.1 PDP Hydromodification Flow Control Equivalency Currency

The PDP's hydromodification flow control equivalency currency (i.e., the amount of mitigation the PDP will be required to provide or purchase from a bank) is the proposed total impervious area of the PDP, or "Deficit of Total Impervious Area Effectively Managed." The proposed total impervious area of the PDP shall be assumed to function as DCIA. To determine the PDP's hydromodification flow control equivalency currency, sum up the area of all of the proposed impervious surfaces (e.g., roofs, concrete, asphalt, etc.) and semi-impervious surfaces (e.g., permeable pavement, pavers, or crushed aggregate) in the PDP. Semi-impervious surfaces shall be treated as impervious surfaces for the purpose of PDP hydromodification flow control equivalency currency calculation because there is currently no validated method to estimate an equivalent impervious area as a fraction of the total semi-impervious area. Only pervious landscape surfaces that would utilize the same pervious rainfall loss parameters as pre-development surfaces if modeled using HSPF or SWMM may be excluded from the calculation.

3.2.2 ACP Hydromodification Flow Control Currency

The ACP's hydromodification flow control equivalency currency, Earned DCIA Effectively Managed, is the existing DCIA effectively managed or mitigated by the ACP. This may be determined by one of two methods: (1) measure the actual DCIA within the ACP drainage area, or (2) when it is not feasible to directly measure DCIA within the ACP drainage area, estimate the total existing impervious area within the ACP drainage area based on California Impervious Surface Coefficients (see "User's Guide for the California Impervious Surface Coefficients," available from http://oehha.ca.gov/ecotox/iscug123110.html), and then estimate the subset of existing DCIA using an appropriate Sutherland EIA Equation for effective impervious area (herein DCIA) (see "Methods for Estimating the Effective Impervious Area of Urban Watersheds," Technical Note #58 from Watershed Protection Techniques 2(I): 282-284, included in **Appendix C** of this document).

3.3 Location Requirements

As stated above, it is assumed that one directly connected impervious acre effectively managed (e.g., mitigated by a flow control facility) is as valuable as another directly connected impervious acre effectively managed, *as long as strict requirements for the location of the ACP relative to the PDP are met*. The purpose of the location requirements is to prevent the PDPs using alternative compliance from creating a new impact to a stream through the addition of new impervious area draining directly to the stream without mitigation. A PDP seeking to use offsite mitigation must use an ACP that meets location requirements specific to the PDP. An ACP owner may only sell the Earned DCIA Effectively Managed by the ACP to a PDP if the ACP meets the location requirements of the PDP.

3.3.1 Determining ACP Location Requirements for a PDP

To determine location requirements for an ACP specific to a PDP, first identify the PDP scenario type from the following (i.e., the PDP is proposing):

- New development
- Redevelopment with increased impervious area
- Redevelopment with NO increase in impervious area

ACP location requirements for PDP scenario types that increase impervious area (new development and redevelopment with increased impervious area) are more restrictive than ACP location requirements for the PDP scenario type that does not increase impervious area (redevelopment with NO increase in impervious area). The purpose is to prevent the PDP from creating a new impact to a stream through the addition of new impervious area draining directly to the stream without mitigation. Redevelopment with NO increase in impervious area is not expected to create a new impact to a stream, therefore the location of the ACP is more flexible.

After identifying the PDP scenario type, refer to **Table 3-1** for the location requirements, and see **Figures 3-2** and **3-3.**

Table 3-1: ACP Location Requirements by PDP Scenario Type

PDP Scenario Type	ACP Location Requirements
• **New Development** • **Redevelopment Increasing Impervious Area**	• ACP location must be within the same local watershed/system (drains to the same susceptible receiving water as the PDP), AND • Mitigation must be provided at or before the discharge point to the susceptible receiving water, AND • The total existing DCIA draining to the ACP must be greater than or equal to the PDP DCIA to be mitigated (i.e., the drainage area draining to the ACP must generate as much or more runoff as the PDP area requiring mitigation).
• **Redevelopment with NO increase in impervious area**	• ACP location must be within the same hydrologic unit but does not have to be within the same local watershed/system (may drain to a different susceptible receiving water within the same hydrologic unit), AND • ACP location must not be an HMP exempt location, AND • The total existing DCIA draining to the ACP must be greater than or equal to the PDP DCIA to be mitigated (i.e., the drainage area draining to the ACP must generate as much or more runoff as the PDP area requiring mitigation).

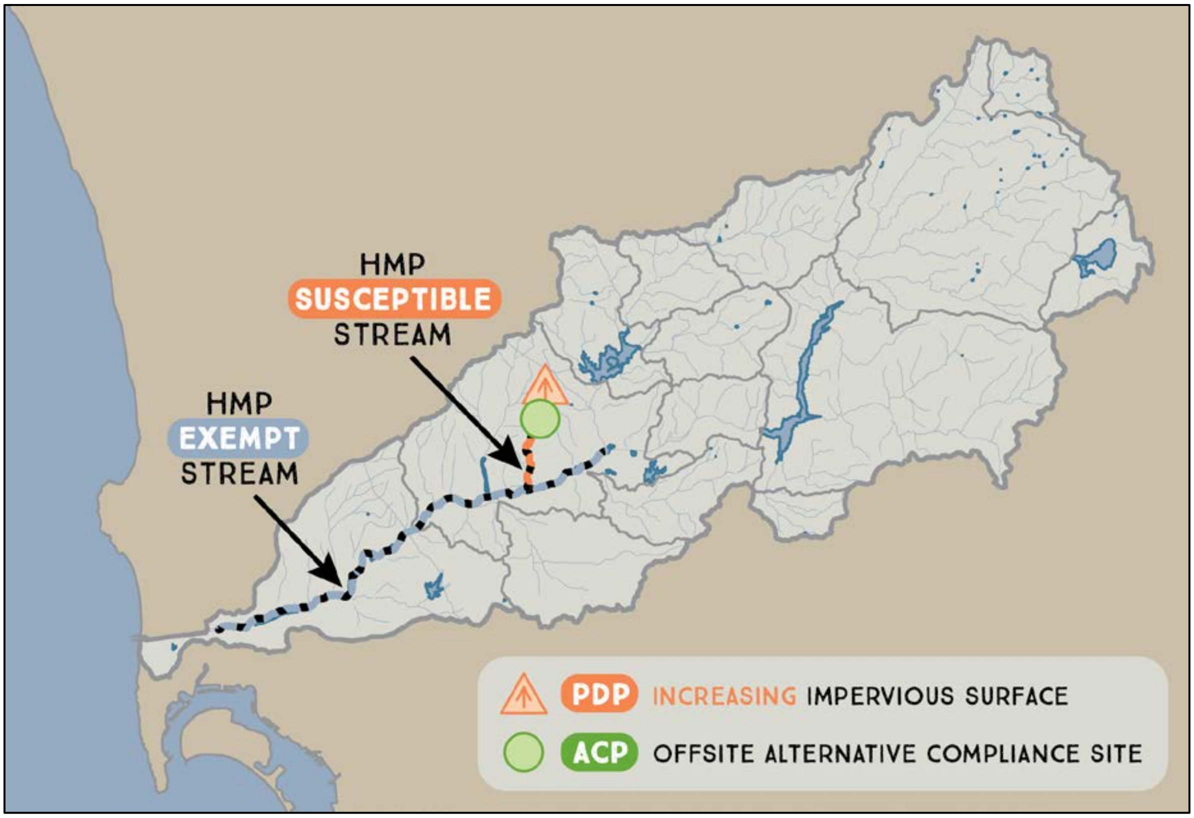

Figure 3-2: Required ACP Location for PDP Increasing Impervious Surface

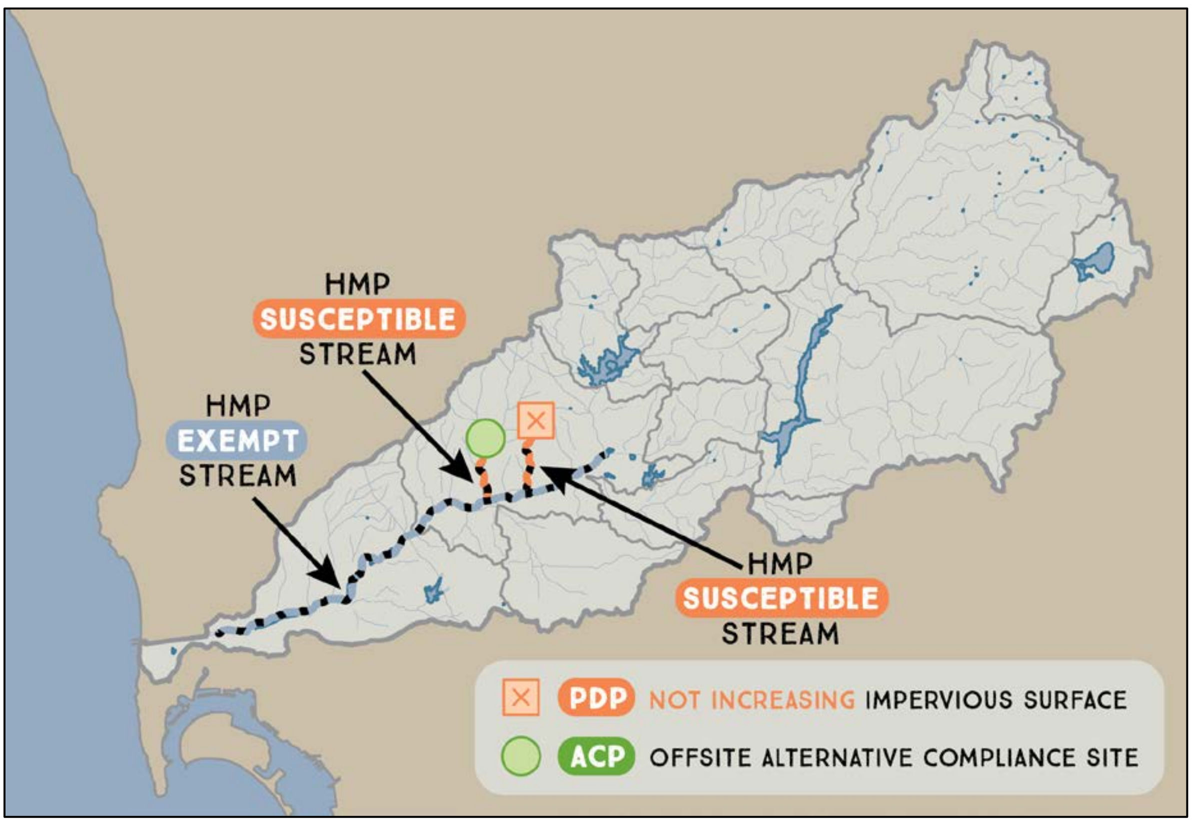

Figure 3-3: Example ACP Location for PDP Not Increasing Impervious Surface

3.3.2 ACP Location Guidelines for Independent ACPs

An Independent ACP may be created anywhere that is not HMP exempt. The ACP owner may only sell the Earned DCIA Effectively Managed by the ACP to a PDP buyer if the ACP meets the PDP's location requirements presented in **Table 3-1** above.

3.4 Design Guidelines for ACPs

The BMPDM presents several accepted models for calculating HMP Q and volume for flow control facilities. Any accepted model may be used to design an Applicant-Implemented or Independent ACP. The designer of the ACP shall use the version of the BMPDM that is in effect at the time of the ACP development permit application.

3.4.1 Sizing an Applicant-Implemented ACP

Based on location requirements presented above, the total existing DCIA draining to the ACP must be greater than or equal to the PDP DCIA to be mitigated (i.e., the drainage area draining to the ACP must generate as much or more runoff as the PDP area requiring mitigation). This will ensure that the ACP can mitigate at least the amount of runoff that the PDP would have been required to mitigate onsite. It is very unlikely that an exact match of existing DCIA will be found. The total existing DCIA draining to the ACP will usually be greater than the PDP DCIA to be mitigated. There are two options for sizing an applicant-implemented ACP when the existing DCIA draining to the ACP is greater than the PDP DCIA to be mitigated. The first option is to provide an amount of mitigation equal to the mitigation required for the PDP only, and bypass additional runoff from the larger drainage area. This option will mitigate the PDP but not generate any additional Earned DCIA Effectively Managed. The second option is to provide mitigation for the total existing DCIA draining to the ACP and generate Earned DCIA Effectively Managed for any excess DCIA mitigated.

3.4.1.1 New Development or Redevelopment Increasing Impervious Area

Based on location requirements presented above, the ACP location for a PDP increasing impervious area must be within the same local watershed/system (drains to the same susceptible receiving water as the PDP). Therefore it can be assumed that the lower flow threshold of the range of flows to control for hydromodification management will be the same for the ACP location as the PDP location. The applicant shall either:

A. Design the flow control facility to the *PDP <u>HMP Q and volume.</u>* If the area draining to the ACP is greater than the new development project or redevelopment project area to be mitigated, bypass additional runoff generated from additional area via safe overflow outlet. There will be no extra Earned DCIA Effectively Managed to sell. OR,

B. Provide a flow control facility designed for the *ACP drainage area <u>HMP Q and volume</u>*. Sell Earned DCIA Effectively Managed from any extra existing DCIA mitigated on a 1 acre:1

acre basis. Earned DCIA Effectively Managed may be sold to any PDP scenario type if the ACP meets the location requirements for the buyer's PDP.

3.4.1.2 Redevelopment with NO Increase in Impervious Area

The ACP location for a PDP with NO increase in impervious area is not required to be within the same local watershed/system (not required to drain to the same susceptible receiving water as the PDP). It is possible that the lower flow threshold of the range of flows to control for hydromodification management for the ACP receiving water will be different from the lower flow threshold for the PDP receiving water. The ACP must be sized for the lower flow threshold for the ACP receiving water. The PDP shall either:

A. Provide mitigation for an amount of existing DCIA equal to the *PDP DCIA to be mitigated*. Design to the *HMP Q and volume* associated to that amount of DCIA. *HMP Q and volume* must be determined based on the ACP receiving channel susceptibility, which may be higher (or lower) than the PDP receiving channel susceptibility and therefore may require a greater (or lesser) volume to mitigate the same amount of DCIA. Bypass the rest of the runoff via safe overflow outlet. There will be no extra Earned DCIA Effectively Managed to sell. OR,

B. Provide mitigation for the full *ACP drainage area* *HMP Q and volume* based on the existing DCIA draining to the ACP. Sell Earned DCIA Effectively Managed from any extra existing DCIA mitigated on a 1 acre:1 acre basis. Earned DCIA Effectively Managed may be sold to any PDP scenario type if the ACP meets the location requirements for the buyer's PDP.

3.4.2 Sizing an Independent ACP

An independent ACP may be sized to provide mitigation for any amount of existing DCIA within the ACP drainage area. The ACP shall be sized for the lower flow threshold and volume associated to the DCIA to be mitigated. The lower flow threshold shall be determined based on the ACP receiving channel susceptibility. Earned DCIA Effectively Managed will be based on the existing DCIA mitigated.

Sizing an ACP for future DCIA is also feasible, however Earned DCIA Effectively Managed for future DCIA could only be sold or transferred to PDPs within the actual future DCIA mitigated by the ACP.

3.5 Calculation of Results for Hydromodification Flow Control Equivalency

This Section presents a process for hydromodification flow control equivalency calculations. Calculations to design a flow control facility require continuous simulation modeling, which is outside the scope of this guidance document. Refer to the BMPDM for methods and parameters for continuous simulation modeling.

3.5.1 Applicant-Implemented ACP

If a PDP applicant determines that hydromodification management flow control requirements cannot be satisfied onsite and seeks to use alternative compliance, the PDP applicant shall take the following steps:

1. Calculate PDP hydromodification flow control debit (Deficit of Total Impervious Area Effectively Managed) (see **Section 3.1.1**)
2. Identify the PDP scenario type and determine location requirements for the ACP based on the PDP scenario type (see **Section 3.2.1**)
3. Either propose an applicant-implemented ACP (see **Section 3.3.1**), or buy Earned DCIA Effectively Managed that has been generated and is available for sale from an existing ACP. In either case, the ACP location must meet the location requirements specific to the PDP based on the PDP scenario type.

Example 3-1: PDP Deficit of Total Impervious Area Effectively Managed

Given:

A 53,585 square foot new development PDP will include the following land covers:

- *8,194 square feet of concrete or asphalt driveways, sidewalks, and roadway*
- *19,785 square feet of roofs*
- *1,546 square feet of crushed aggregate on a maintenance access road*
- *12,030 square feet of pervious landscaping*

HMP mitigation will be required for all impervious and semi-impervious surfaces. For the PDP, all impervious and semi-impervious surfaces shall be assumed to perform as DCIA. Therefore the total DCIA requiring mitigation is the sum of the areas of concrete or asphalt driveways, sidewalks, roadway, roofs, and crushed aggregate.

8,194 + 19,785 + 1,546 = 29,525 square feet

The PDP's Deficit of Total Impervious Area Effectively Managed is 29,525 square feet (0.68 acres).

3.5.1.1 Option A (Mitigate PDP Only)

To mitigate the PDP only, the ACP flow control facility must provide mitigation for 29,525 square feet (0.68 acres) of DCIA at a location appropriate to the PDP scenario type.

3.5.1.2 Option B (Mitigate More than the PDP Requirement)

The PDP applicant could propose to provide mitigation for all of the existing DCIA in the ACP drainage area, and generate Earned DCIA Effectively Managed for the extra existing DCIA mitigated. Earned DCIA Effectively Managed will be the difference between the PDP's requirement and the total mitigated.

Assume that the new development PDP described above, which needs to provide mitigation for 29,525 square feet (0.68 acres) of DCIA, has found a suitable location for an ACP. The ACP drainage area is 43,560 square feet (1.00 acres). The ACP location is within the same local watershed/system (drains to the same susceptible receiving water as the PDP). Mitigation will be provided before the discharge point to the susceptible receiving water. Based on detailed investigation of the ACP drainage area, the total existing impervious area draining to the ACP is 41,335 square feet (0.95 acres) and is all directly connected. The applicant-implemented ACP could be designed to mitigate 41,335 square feet of existing DCIA, and earn 0.27 acres of Earned DCIA Effectively Managed (0.95 acres mitigated – 0.68 acres required = 0.27 acres).

3.5.2 Independent ACP

The following are steps for a property owner to design an independent ACP:

1. Identify the drainage area draining to the ACP location
2. Directly measure the total existing DCIA within the ACP drainage area, or estimate using CA ISC and Sutherland EIA Equations
3. Determine the receiving channel susceptibility to erosion (see Section 6 of the BMPDM)
4. Using methods from the BMPDM in effect at the time of the development permit application for the ACP, design the ACP to mitigate up to 100 percent of the existing DCIA within the ACP drainage area (mitigate as much existing DCIA as feasible at the ACP location to maximize the currency earned by the ACP)
5. Determine ACP hydromodification flow control equivalency currency (Earned DCIA Effectively Managed) (see **Section 3.1.2**)
6. Sell or trade Earned DCIA Effectively Managed to PDPs if the ACP location meets the specific location requirements for the PDPs.

If it is not feasible to directly measure existing impervious area and observe the drainage area to confirm directly connected impervious area, the existing impervious area may be estimated using California Impervious Surface Coefficients, and converted to DCIA using an appropriate Sutherland EIA Equation.

Example 3-2: ACP Earned DCIA Effectively Managed - Direct Measurement

Given:

A 20 acre drainage area draining to a proposed ACP includes the following land uses:

- *6 acres retail*
- *6 acres retail/office*
- *5 acres multi-family housing with 10 dwelling units per acre (DU/A)*
- *3 acres road right-of-way*

Assume the following data is obtained from direct measurement from aerial photographs combined with field observations of the drainage area:

- *6 acres retail contains 4.8 acres existing impervious area, all directly connected*
- *6 acres retail/office contains 5.1 acres existing impervious area, all directly connected*
- *5 acres multi-family housing contains 3.25 acres existing impervious area, all directly connected*
- *3 acres road right-of-way contains 2.7 acres existing impervious area, all directly connected*

The total existing impervious area within the drainage area is 15.85 acres and is all directly connected. The ACP can generate Earned DCIA Effectively Managed for mitigating up to 15.85 acres of existing DCIA using a flow control facility properly designed according to the BMPDM.

Example 3-3: ACP Earned DCIA Effectively Managed - Land Use Estimation

Given:

A 20 acre drainage area draining to a proposed ACP includes the following land uses:

- *6 acres retail*
- *6 acres retail/office*
- *5 acres multi-family housing with 10 dwelling units per acre (DU/A)*
- *3 acres road right-of-way*

1. Determine the impervious surface based on land use by multiplying the area of each land use by the California Impervious Surface Coefficient

- *6 acres retail * 0.86 (CA ISC for retail land use) = 5.16 acres impervious area*
- *6 acres retail/office * 0.80 (CA ISC for retail/office land use) = 4.80 acres impervious area*
- *5 acres multi-family housing * 0.60 (CA ISC for multi-family residential land use 10 DU/A) = 3.00 acres impervious area*
- *3 acres road right-of-way * 0.91 (CA ISC for road right-of-way) = 2.73 acres impervious area*

The estimated existing impervious area is 15.69 acres.

2. Convert the estimated existing impervious surface area to DCIA. the Sutherland EIA Equation for a highly connected basin will be used:

$EIA = 0.4 * (TIA)^{1.2}$

Where:
EIA = Directly Connected Impervious Area
TIA = Total Impervious Area

$0.4 * (15.69 \text{ acres})^{1.2} = 10.88 \text{ acres}$

The estimated existing DCIA is 10.88 acres. The ACP can generate Earned DCIA Effectively Managed for mitigating up to 10.88 acres of existing DCIA using a flow control facility properly designed according to the BMPDM.

3.6 Hydromodification Flow Control Equivalency for Stream Rehabilitation

Hydromodification flow control equivalency for stream rehabilitation is based on the principle that greater overall watershed benefit is achieved when stream rehabilitation measures are designed to mitigate both future and legacy hydromodification impacts associated with development that occurs within the watershed. The amount of rehabilitation that is required is dependent on the current condition of the receiving waters and planned development in the watershed and is anticipated to vary within and between watersheds.

The following steps shall be followed to estimate the amount of stream rehabilitation that is required to offset proposed Priority Development Project and legacy impacts and the amount of credits that can be generated from implementing the required stream rehabilitation activities:

1. Identify the stream rehabilitation hydromodification equivalency scenario (see **Section 3.6.1**)
2. Estimate the geomorphic stability of the receiving waters in the watershed by performing the channel assessment process (see **Section 3.6.2**)
3. For Applicant-Implemented ACPs, estimate the geomorphic impact on the receiving waters considering Priority Development Project development as well as existing development in the watershed. For Independent ACPs, estimate the geomorphic impact on the receiving waters in the build out condition. Build out condition shall be based on planned development projects through 2050 or project specific timeframe approved by the local governing Copermittee.
4. Compare the results from Step 2 and Step 3 to determine if stream rehabilitation is necessary. This can be determined through application of **Equation 3-1**.
5. For Independent ACPs, estimate the amount of hydromodification credits that are generated (see **Section 3.6.3**)

Equation 3-1: Determination of Stream Geomorphic Capacity

$$SGC = GS_{RW} - GI_{FC}$$

Where:

SGC: Stream Geomorphic Capacity

GS_{RW}: Geomorphic Stability – Receiving Water

GI_{FC}: Geomorphic Impact – Future Condition

When:

$SGC \geq 0$; Stream segment does not require rehabilitation

$SGC < 0$; Stream segment requires rehabilitation

3.6.1 Stream Rehabilitation Hydromodification Equivalency Scenario

The following implementation scenarios may be allowed for stream rehabilitation projects performing equivalency calculations:

1. Applicant-Implemented PDP-based stream rehabilitation project for impacts caused by the PDP and legacy impacts, if it's determined that the project would provide a greater overall benefit to the sub-watershed and is approved by the local governing Copermittee.
   a. In this scenario the PDP will perform channel assessment process (see **Section 3.6.2**) for the domain of analysis determined based on the outfall of the PDP. In this

process, sensitive stream segments requiring stream rehabilitation will be identified downstream to an exempt water body (see **Figure 3-4**).

b. To offset impacts of the PDP and to address legacy issues, the PDP will then rehabilitate the sensitive stream segments in the domain of analysis downstream of the PDP outfall to the exempt water body. The stream rehabilitation will be designed for the existing condition and additional imperviousness added by the PDP.

c. Stream rehabilitation activities are only applicable to offset impacts of PDP. No credits would be generated. Any additional future development that may occur in the watershed would be required to implement site-specific hydromodification flow control.

2. Watershed-based stream rehabilitation for sensitive portions of the receiving water in a sub-watershed for full planned development.

    a. In this scenario the applicant will perform the channel assessment process (see **Section 3.6.2**) for all stream segments in the sub-watershed that receive flows from planned development projects and identify the sensitive stream segments that require stream rehabilitation (see **Figure 3-5**).

    b. Applicant will then rehabilitate the sensitive stream segments in the sub-watershed.

    c. Credits that are generated by the stream rehabilitation activities are to be estimated by the sum of:

        i. New impervious area to be added in the sub-watershed (i.e. developable land and infill); and

        ii. Anticipated redevelopment in the sub-watershed.

    d. Credit can only be used for development projects that directly discharge to the assessed streams. For the development project to qualify for credits, all the identified sensitive stream segments from the project to the downstream exempt water body should be rehabilitated.

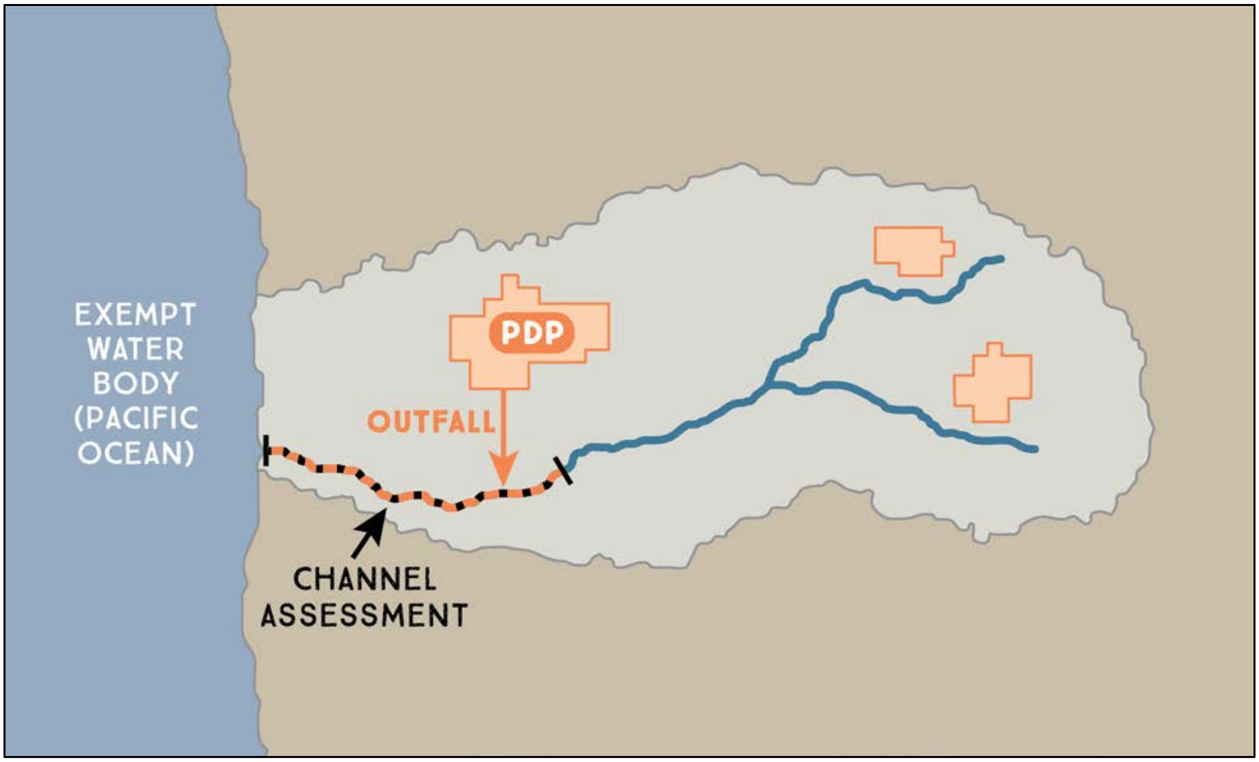

Figure 3-4: PDP-Based Stream Rehabilitation

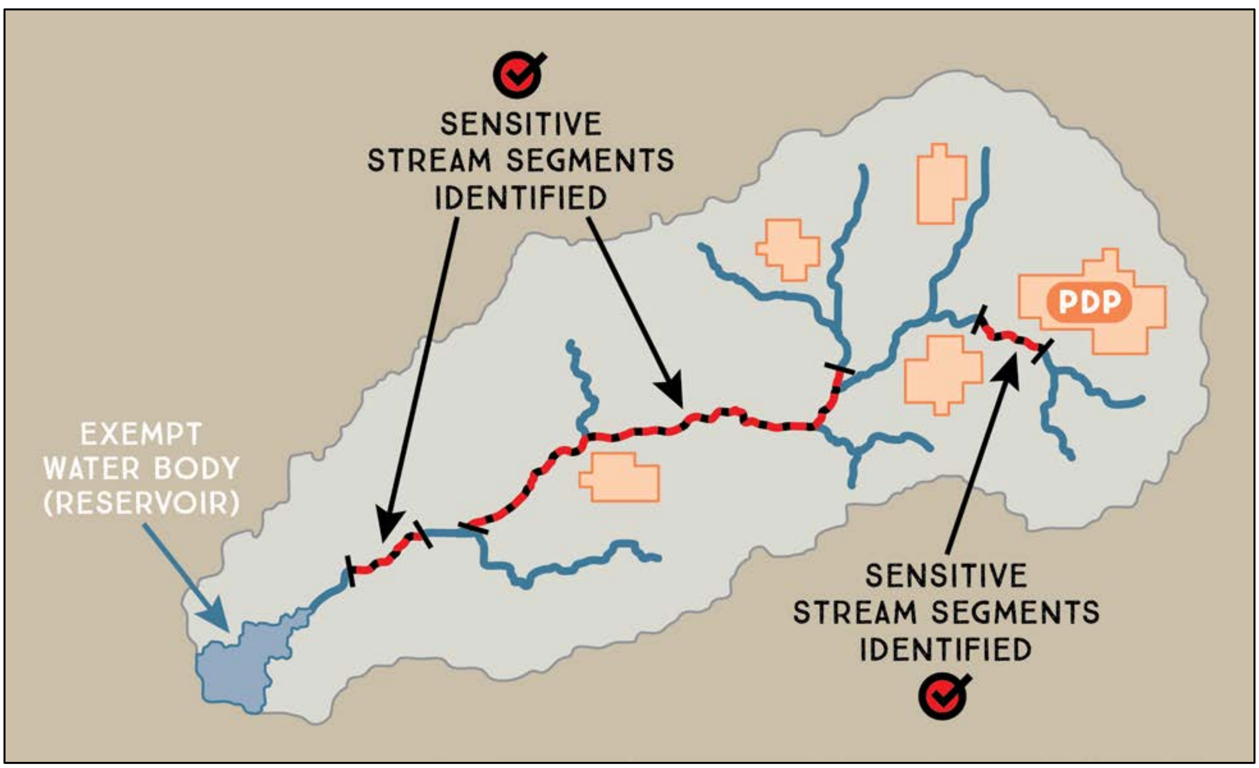

Figure 3-5: Watershed-Based Stream Rehabilitation

3.6.2 Channel Assessment Process and Stream Rehabilitation Approach

To determine the segments of the receiving waters in the watershed that require stream rehabilitation, the following channel assessment process is proposed (see **Figure 3-6**):

1. For the selected equivalency scenario (see **Section 3.6.1**) identify the domain of analysis and divide the domain of analysis into similar geomorphic channel units (GCUs; See **Section C.2.1**).
2. For each GCU perform field assessment using the SCCWRP channel evolution model to determine if the channel form is stable or unstable.
3. For GCUs that are determined to have stable forms estimate the geomorphic stability of the receiving water and the geomorphic impact for the build out condition. Geomorphic impact shall be evaluated using erosion potential (Ep) and specific stream power (See **Appendix C.2.3** for guidance on estimating geomorphic stability and geomorphic impact).
    a. No hydromodification management BMPs are necessary for a GCU if it can meet the Ep and specific stream power criteria for future condition.
4. For GCUs that are determined to have unstable forms perform field assessment using guidance provided by SCCWRP Technical Report 606.
5. Provide hydromodification mitigation measures:
    a. For stable form GCUs that cannot support Ep or specific stream power for future condition, out-of-stream hydromodification management BMPs (onsite and/or regional detention) might be preferred solution. In-stream rehabilitation may be allowed at the discretion of local governing Copermittee.
    b. For unstable form GCUs, rehabilitate the GCU by widening or flattening the stream and/or add reinforcement of bed and bank material unit the GCU meets the required performance standard in **Appendix C.2.5**. When the vertical and/or lateral susceptibility is medium or high the preferred solution would be in-stream rehabilitation and when both vertical and lateral susceptibility is low the preferred solution might be out-of-stream hydromodification management BMPs (onsite and/or regional detention). In-stream rehabilitation may be allowed at the discretion of local governing Copermittee.

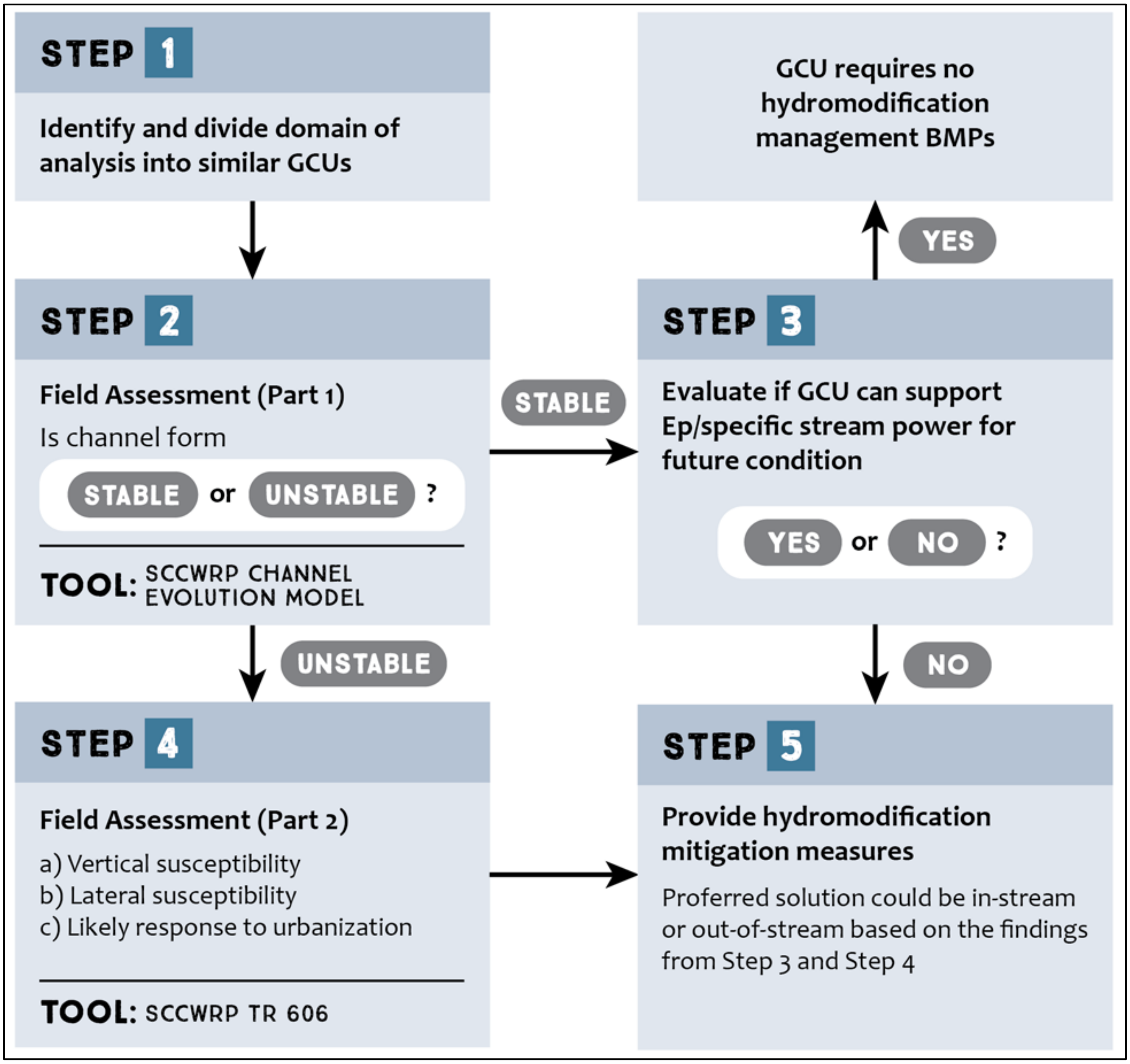

Figure 3-6: Overview of Channel Assessment Process

The channel assessment process to be completed, assuming that stormwater discharges from impervious surfaces of a given area, to streams with similar physical attributes (e.g. slope, channel morphology, channel material, and stream order), will have similar geomorphic and biological responses (e.g. channel incision), and can be mitigated by similar restoration actions (e.g. creation of a widened floodplain around the channel). Conversely, discharges into stream channels with different physical attributes are expected to have different geomorphic responses, and require different restoration actions to attain stability.

The details for completing the channel assessment process are included in **Appendix C.2** of this document. Guidance is based on the San Diego HMP for in-channel mitigation which was presented as an alternative, or supplement, to flow volume and duration control. In-stream mitigation involves the modification of the receiving channel (primarily by altering its width, depth, slope and channel materials) to accommodate increased flow magnitudes and durations following development.

3.6.3 Stream Rehabilitation Hydromodification Flow Control Currency

The hydromodification flow control equivalency currency for stream rehabilitation projects is DCIAs in the watershed that are required to implement hydromodification flow control BMPs to meet the requirements established by the MS4 Permit (see **Section 3.2** for discussion on DCIA). The proposed time frame for development projects to be eligible for inclusion while estimating the DCIAs that would benefit from the stream rehabilitation projects is from the effective date of this document to 2050. The timeframe could be modified on a project by project basis at the discretion of the local governing Copermittee.

4. EXAMPLE WATER QUALITY EQUIVALENCY CALCULATIONS BY PROJECT TYPE

This section of the guidance provides example WQE calculations for six specific project types as identified below.

Structural Best Management Practices (Structural BMPs)

Example 4-1. Retrofit BMPs
Example 4-2. Regional BMPs
Example 4-3. Water Supply BMPs

Natural System Management Practices (NSMPs)

Example 4-4. Land Restoration NSMPs
Example 4-5. Land Preservation NSMPs
Example 4-6. Stream Rehabilitation NSMPs

4.1 Example 4-1: Retrofit BMPs

Problem Statement

A property owner owns an existing 1.25-acre parking lot and 0.25 acres landscaped area adjacent to the parking lot. In the existing condition runoff from both the parking area and the landscaped area are collected into a catch basin connected to an existing urban stormwater conveyance system. There are no existing stormwater controls onsite or within the existing urban stormwater conveyance system downstream. The landscaped area can be modified to accept runoff from the parking area, and can potentially be utilized to provide pollutant control and hydromodification management flow control benefits for the existing parking lot. Design an ACP to retrofit into the landscaped area. The desired structural BMP type is biofiltration. Assume that the structural BMP will include (from top layer to bottom layer): 10 inches of active storage ponding depth, 18 inches of bioretention soil media, and 18 inches of active storage in gravel drained by an underdrain, consistent with the structural BMP described in Appendix G.2.4 of the BMPDM. The biofiltration BMP will not include an impermeable liner at the bottom of the facility to prevent infiltration into underlying soils. However, there will be no dead storage in gravel below the facility underdrain, therefore the structural BMP will not meet requirements to be considered a retention BMP.

The following is the example problem data:

- *ACP Tributary Area: 1.5 acres*
- *Watershed Management Area: San Dieguito*
- *85th Percentile Rainfall Depth: 0.8 inches*
- *Receiving Channel Susceptibility to Erosion: High*
- *Rain Gauge for Hydromodification Sizing Factor Calculations: Lake Wohlford*
- *NRCS Hydrologic Soil Group: D*
- *ACP Tributary Slope: 2%*
- *Land Use Characteristics: 1.25 acres impervious (parking) and 0.25 acres pervious landscaping*

(Continued on next page)

Part I: WQE for Stormwater Pollutant Control

Step 1: PDP Stormwater Pollutant Control Calculations

This is an Independent ACP and information pertaining to a specific PDP is not available to the ACP applicant at this time. Therefore, this step is not applicable for this ACP.

Step 2: ACP Stormwater Pollutant Control Calculations

The Earned Stormwater Pollutant Control Volume will be calculated per ***Equation 2-1***.

$V_E = L\ (\Delta V + V_2B_2 - V_1B_1)$

Where:
V_E: *Earned Stormwater Pollutant Control Volume* (ft^3)
L: Land Use Factor
ΔV: *Change in Design Capture Volume* ($V_1 - V_2$)
V_1: *Impacted Condition Design Capture Volume for ACP*
V_2: *Mitigated Condition Design Capture Volume for ACP*
B_1: *Impacted Condition BMP Efficacy Factor*
B_2: *Mitigated Condition BMP Efficacy Factor*

Task 2-1: Calculate DCV Tributary to the ACP **(V_1, V_2, ΔV)**

In order to perform water quality equivalency calculations, the ACP applicant must determine the impacted condition DCV (V_1), the mitigated condition DCV (V_2), and the change in DCV (ΔV) as presented below.

Calculate Impacted Condition DCV (V_1)

The tributary area is given above as 1.5 acres. Per methods presented in Appendix B.1 of the BMPDM, the area weighted average runoff coefficient is calculated to be 0.77 (C=0.90 for 1.25 acre impervious portion and C=0.10 for 0.25 acre pervious portion of the tributary). The average 85th percentile storm event depth for this tributary is determined to be 0.8 inches based on isopluvial maps (given in the example problem data). Therefore, the impacted condition DCV (V_1) for this project is calculated as:

V_1 = *Runoff Coefficient x Rainfall Depth x Tributary Area*
V_1 = *0.77 x 0.80 in x 1.50 ac x (43,560 ft^2 /1 ac) x (1 foot/12 in) = 3,354 cubic feet*

Calculate Mitigated Condition DCV (V_2)

The proposed ACP does not alter runoff coefficients within the ACP tributary; therefore, the mitigated condition DCV is equal to the impacted condition DCV ($V_1 = V_2$).

V_2 = *Runoff Coefficient x Rainfall Depth x Tributary Area*
V_2 = *0.77 x 0.80 in x 1.50 ac x (43,560 ft^2 /1 ac) x (1 foot/12 in) = 3,354 cubic feet*

Calculate Change in DCV (ΔV)

The impacted condition DCV and the mitigated condition DCV are equal; therefore, the change in DCV is equal to zero.

$\Delta V = V_1 - V_2$
ΔV = *0 cubic feet*

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Task 2-2: Calculate Land Use Factor (L)

To calculate a land use factor, the applicant must identify the WQE pollutants of concern, relative pollutant concentrations for the ACP tributary, and relative pollutant concentrations for the reference tributary.

Task 2-2A: WQE Pollutants of Concern

The ACP is identified to be within the San Dieguito WMA and hydrologic unit, so the WQE pollutants of concern are TP, TN, and FC per ***Table 2-1*** *of this guidance.*

Task 2-2B: ACP Tributary Relative Pollutant Concentrations

The ACP tributary is characterized by the land uses identified in the example description above.

Task 2-2C: Reference Tributary Relative Pollutant Concentrations

The reference tributary for an Independent ACP within the San Dieguito WMA is characterized by the land use composition values presented in ***Table 2-3*** *of this guidance.*

Task 2-2D: Determine Land Use Factors

The appropriate land use compositions and associated runoff factors from the tasks above are then tabulated into the input fields of ***Worksheet A.5*** *and associated land use factors are calculated for each WQE pollutant of concern using* ***Equation 2-2****. This step may also be performed through utilization of the automated land use factor calculation tool available on www.projectcleanwater.org, as is demonstrated in this example. The lowest resulting land use factor is selected for incorporation into the stormwater pollutant reduction calculations. Therefore, the land use factor for this ACP is based on Total Phosphorus (TP) which equals 0.46 as depicted in* ***Worksheet A.5.***

Land Use Designation	ACP Tributary Characteristics		Reference Tributary Characteristics [2]		Relative Pollutant Concentrations by Land Use [3]						
	Area (Acres)	Runoff Factor [1]	Area (Acres)	Runoff Factor [1]	TSS	TP	TN	Tcu	TPb	TZn	FC
Agriculture	0.00	0.10	17,078.00	0.10	0.45	1.00	1.00	1.00	1.00	0.59	1.00
Commercial	1.50	0.80	1,732.00	0.80	0.13	0.16	0.16	0.56	0.48	1.00	0.87
Education	0.00	0.50	1,958.00	0.50	0.13	0.20	0.11	0.14	0.25	0.39	0.13
Industrial	0.00	0.90	693.00	0.90	0.13	0.19	0.15	0.54	0.68	0.89	0.49
Multi Family Residential	0.00	0.60	963.00	0.60	0.10	0.13	0.13	0.14	0.15	0.29	0.27
Orchard	0.00	0.10	3,860.00	0.10	0.18	0.17	0.67	1.00	1.00	0.59	0.11
Rural Residential	0.00	0.30	21,741.00	0.30	1.00	0.51	0.14	0.10	0.71	0.13	0.19
Single Family Residential	0.00	0.40	15,719.00	0.40	0.13	0.20	0.15	0.27	0.43	0.35	0.63
Transportation	0.00	0.90	6,325.00	0.90	0.11	0.26	0.12	0.53	0.31	0.62	0.12
Vacant / Open Space	0.00	0.10	0.00	0.10	0.16	0.10	0.10	0.12	0.10	0.10	0.10
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.50	-	70,069.00	-	-	-	-	-	-	-	-
	Relative Pollutant Concentration for ACP Tributary [4]				0.13	0.16	0.16	0.56	0.48	1.00	0.87
	Relative Pollutant Concentration for Reference Tributary [4]				0.38	0.35	0.21	0.36	0.52	0.43	0.39
	Watershed Management Area				San Dieguito River						
	Hydrologic Unit				San Dieguito (905.00)						
	Land Use Factor [5]				-	**0.46**	**0.77**	-	-	-	**2.23**

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Task 2-3: Calculate BMP Efficacy Factors ***(B_1, B_2)***

BMP efficacy factors are a function of an ACP's pollutant removal efficiency (Task 2-3a) and provided capture values (Task 2-3b). To perform water quality equivalency calculations, applicants must determine the impacted condition BMP efficacy factor (B_1), and the mitigated condition BMP efficacy factor (B_2).

Impacted Condition BMP Efficacy Factor (B_1)

The impacted condition of a retrofit BMP corresponds with the existing site conditions. There are no existing BMPs in this example; therefore, the impacted condition BMP efficacy factor (B_1) is 0.00.

Mitigated Condition BMP Efficacy Factor (B_2)

*The mitigated condition of a retrofit BMP corresponds with site conditions anticipated after the ACP is completed. The ACP proposes to construct a biofiltration BMP, so it will utilize **Equation 2-3** to calculate a BMP efficacy factor. The pollutant removal efficiency for biofiltration BMPs is always 0.666; however, the provided capture factor may vary with respect to the geometry of the proposed biofioltration BMP. The biofiltration BMP sized will be determined by using **Worksheet A.2** and selecting a size that will maximize the BMP provided capture factor, which will maximize the mitigated condition BMP efficacy factor (B_2). Based on the June 2015 BMPDM, the minimum biofiltration BMP size must be at least 3% of the area draining to the BMP after adjusting the area by the runoff factor.*

Minimum biofiltration size = 0.03 x 1.5 acres x 0.77 x 43,560 ft^2 / acre = 1,510 square feet

*The mitigated condition BMP efficacy factor (B_2) will be calculated through the methodology presented in **Section 2.3.1.3.3** of this manual.*

1. *The ACP DCV was calculated to be 3,354 cubic feet in Step 2-1.*
2. *Using **Worksheet A.2** and entering the design parameters for surface ponding depth, soil media depth, and gravel depth provided in the example problem data, the BMP provided capture factor can be maximized at 1.50 with a provided BMP surface area of **1,510** square feet. A copy of **Worksheet A.2** calculations is provided below.*
3. *In this example, the biofiltration BMP efficiency is maximized when analyzed using Option 1 (biofilter at least 1.5 times the portion of the DCV not reliable retained onsite) as stated in the Permit. In this example, the provided biofiltration volume is calculated to be 5,031 cubic feet, which is 100% of the target biofiltration volume for Option 1. The fraction of required biofiltration volume provided is 5,031 cubic feet (provided) / 5,031 cubic feet (target) = **1.0.***
4. *Determine the provided capture value: For biofiltration BMPs, the provided capture value is equivalent to the fraction of required biofiltration volume (Option 1) or storage volume (Option 2) that is provided (calculated in Step 3 above) multiplied by 1.50, with a maximum allowable value of 1.50. Therefore, the provided capture value = 1.0 x 1.50 = **1.50**.*
5. *The mitigated condition BMP efficacy factor (B_2) can be calculated per **Equation 2-3**:*

   $B_2 = E \times C$

   Where:

   B_2: Mitigated Condition BMP Efficacy Factor

   E: Pollutant Removal Efficiency (***Section 2.3.1.3.1***, E = 0.666)

   C: Provided Capture Factor (***Section 2.3.1.3.2.2***)

   $B_2 = (0.666 \times 1.50) = 1.00$

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Worksheet A.2: Biofiltration BMP Efficacy Factor Determination for Water Quality Equivalency

Category	#	Description	Value	Units
BMP Inputs	0	Effective Tributary Area	50,312	sq-ft
	1	Design Capture Volume Tributary to BMP	3,354	cubic-feet
	2	Provided BMP Surface Area	1,510	sq-ft
	3	Provided Surface Ponding Depth	10	inches
	4	Provided Soil Media Thickness	18	inches
	5	Provided Gravel Storage Thickness	18	inches
	6	Hydromodification Orifice Diameter of Underdrain	n/a	inches
Biofiltration Calculations	7	Max Hydromod Flow Rate through Underdrain	n/a	CFS
	8	Max Soil Filtration Rate Allowed by Underdrain Orifice	n/a	in/hr
	9	Soil Media Filtration Rate	5.00	in/hr
	10	Soil Media Filtration Rate to be used for Sizing	5.00	in/hr
	11	Depth Biofiltered Over 6 Hour Storm	30.00	inches
	12	Soil Media Pore Space	0.30	-
	13	Gravel Pore Space	0.40	-
	14	Effective Depth of Biofiltration Storage	22.6	inches
	15	Drawdown Time for Surface Ponding	2	hours
	16	Drawdown Time for Entire Biofiltration Basin	5	hours
	17	Total Depth Biofiltered	52.60	inches
	18	Option 1 - Biofilter 1.50 DCV: Target Volume	5,031	cubic-feet
	19	Option 1 - Provided Biofiltration Volume	5,031	cubic-feet
	20	Option 2 - Store 0.75 DCV: Target Volume	2,516	cubic-feet
	21	Option 2 - Provided Storage Volume	2,516	cubic-feet
	22	Provided Capture for Biofiltration BMP	1.50	ratio
	23	**Biofiltration BMP Efficacy Factor for Use in WQE Formula**	1.00	ratio

Task 2-4: Calculate Earned Stormwater Pollutant Control Volume *(V_E)*

The Earned Stormwater Pollutant Control Volume for an ACP is calculated by populating ***Equation 2-1*** *with the appropriate volumes, land use factors and BMP efficacy factors determined per the guidelines set forth in* ***Section 2.3****. The Earned Stormwater Pollutant Control Volume for this ACP is calculated as:*

$V_E = L\ (\Delta V + V_2 B_2 - V_1 B_1)$

$V_E = 0.46 \times [0 \text{ cubic feet} + (3{,}354 \text{ cubic feet} \times 1.00) - (3{,}354 \text{ cubic feet} \times 0.00)]$

$V_E = 1{,}543 \text{ cubic feet}$

Step 3: Determination of Stormwater Pollutant Control Credits

An overall water quality benefit for stormwater pollutant control can be demonstrated if the Earned Stormwater Pollutant Control Volume calculated in Step 2 is greater than or equal to the Deficit of Stormwater Pollutant Control Volume calculated in Step 1. Because this is an Independent ACP, a volume has not yet been determined for Step 1. Therefore, a Stormwater Pollutant Control Volume Credit of 1,543 cubic feet may be banked for potential future purchase by a PDP applicant with a Deficit of Stormwater Pollutant Control Volume of 1,543 cubic feet or less. Note that trading/selling of such credits is contingent on the approval of a credit system.

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Part II: WQE for Hydromodification Flow Control

The example calculation will follow the steps presented in **<u>Example 4.1 Part I</u>**. *The sizing factor method presented in Chapter 6.3.5.1 and Appendix G.2 of the BMPDM will be used to determine a size for the ACP. References to "Appendix" or "Table" with a prefix of "G" refer to the BMPDM. Use of the sizing factor method is not intended as an endorsement of this method and should not imply that it is required for ACP calculations. An ACP for hydromodification flow control may be sized based on project-specific continuous simulation modeling and may result in a different size than the ACP calculated in this example. The sizing factor method was selected because it is the simplest format to present in this WQE document.*

<u>Step 1: Identify the drainage area draining to the ACP location</u>

Based on the problem data provided, the total drainage area is 1.5 acres, consisting of 1.25 acres of existing impervious area plus 0.25 acres of existing pervious area where the proposed ACP will be located.

<u>Step 2: Directly measure the total existing DCIA within the ACP drainage area, or estimate using CA ISC and Sutherland EIA equations</u>

The parking lot is 100% impervious and directly connected to the existing urban stormwater conveyance system. Therefore the total existing DCIA is 1.25 acres.

<u>Step 3: Determine the receiving channel susceptibility to erosion (see Section 6 of the BMPDM)</u>

The purpose of this step is to determine the fraction of Q2 to control for hydromodification management flow control design. Assume the receiving channel susceptibility to erosion has been determined to be high as given in the problem data. Therefore the low flow threshold for design is 0.1Q2 as required by the BMPDM.

<u>Step 4: Using methods from the BMPDM in effect at the time of the development permit application for the ACP, design the ACP to mitigate up to 100% of the existing DCIA within the ACP drainage area</u>

As stated above, the sizing factor method will be used for the example problem calculation. Based on Appendix G.2, this requires information describing the rainfall basin, hydrologic soil group, slope category, tributary drainage area, area-weighted runoff factor, and fraction of Q2 to control. All of this information has been given in the example problem data except the area-weighted runoff factor. Using methods presented in Appendix G.2, where the runoff factors are 1.0 for impervious area and 0.1 for pervious area for sizing factor calculations, the area-weighted runoff factor is:

((1.25 acres impervious area x 1.0) + (0.25 acres pervious area x 0.1)) / 1.5 acres = 0.85

<u>Step 4.1 (Step 1 for sizing factor calculations)</u>

The pre-development Q2 is determined based on the unit runoff ratio from Table G.2-2 multiplied by the total drainage area. The pre-development Q2 is then converted to the low flow threshold for hydromodification management flow control design by multiplying by the fraction of Q2 to control based on receiving channel susceptibility to erosion.

Based on Table G.2-2, the unit runoff ratio for Lake Wohlford rain gauge, soil group D, scrub cover (required cover category to represent pre-development condition), and low slope (between 0% to 5%), is 0.253 cfs/acre.

(Continued on next page)

Pre-development Q2 = 1.5 acres x 0.253 cfs/acre = 0.38 cfs

Low flow threshold = 0.1Q2 = 0.1 x 0.38 cfs = 0.04 cfs

<u>Step 4.2 (Step 2 for sizing factor calculations)</u>
As shown in the problem statement, the desired structural BMP for this ACP is biofiltration, consistent with the structural BMP described in Appendix G.2.4. The area of the biofiltration BMP will be determined using the sizing factors from Table G.2-5.

Based on Table G.2-5, the area sizing factor for biofiltration with partial retention for lower flow threshold 0.1Q2, soil group D, low slope (between 0% to 5%), Lake Wohlford rain gauge, is 0.100 (acre/acre).

Required area for biofiltration with partial retention = 1.5 acres x 0.85 x 0.100 = 0.13 acres

Note that this required area is based on assumed vertical sides from top to bottom, including in the active storage ponding area. When side slopes are added for the active storage ponding area, the total footprint will be slightly larger than 0.13 acres.

<u>Step 5 Determine ACP hydromodification flow control equivalency currency (existing DCIA mitigated)</u>
*As shown in Step 4.2, the property owner will fit a structural BMP that is sized to provide hydromodification management flow control for the full tributary drainage area. Therefore the hydromodification flow control equivalency currency is the full amount of existing DCIA that will be mitigated by the ACP. The existing DCIA tributary to the ACP was calculated in Step 3: **<u>1.25 acres</u>**.*

Part III: WQE for Stormwater Pollutant Control and Hydromodification Flow Control
The structural BMP designed above for hydromodification management flow control can double as a pollutant control BMP because it provides biofiltration. For pollutant control calculations, assume that the required area shown above (0.13 acres) represents the area measured at the bottom of the active storage ponding area (the interface with the top of the bioretention soil media). The area of bioretention soil media will be 0.13 acres (5,663 square feet). Although the biofiltration BMP area calculated for hydromodification management flow control (5,663 square feet) is much greater than the BMP area calculated for pollutant control (1,510 square feet), it cannot be assumed that the same maximized BMP pollutant control credit is attained, because there will be a flow restrictor added for hydromodification management that will change the soil media filtration rate used in the pollutant control sizing calculations. Therefore a new pollutant control calculation must be performed.

*Use **<u>Worksheet A.2</u>** and enter the design parameters for surface ponding depth, soil media depth, and gravel depth provided in the example problem data, and 5,663 square feet for the provided BMP surface area. The soil media filtration rate to be used for sizing must be adjusted because the flow control orifice provided for hydromodification management will limit the flow through the soil. The low flow orifice must be designed to discharge 0.04 cfs. Select an orifice size that will discharge up to 0.04 cfs. The soil media filtration rate will be updated to match the design discharge rate of the low flow orifice (approximately 0.3 inches per hour as shown by the calculation below for an orifice discharge rate of 0.04 cfs).*

(0.04 cfs x 3,600 seconds/hour x 12 inches/foot) / 5,663 square feet = 0.3 inches / hour

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*Selecting a 0.8-inch orifice provides an orifice flow rate just under 0.04 cfs. However, the BMP fails to drain the surface volume within 24 hours, a requirement for pollutant control design (see line 15 in **Worksheet A.2**, below).*

Worksheet A.2: Biofiltration BMP Efficacy Factor Determination for Water Quality Equivalency

Category	#	Description	Value	Units
BMP Inputs	0	Effective Tributary Area	50,312	sq-ft
	1	Design Capture Volume Tributary to BMP	3,354	cubic-feet
	2	Provided BMP Surface Area	5,663	sq-ft
	3	Provided Surface Ponding Depth	10	inches
	4	Provided Soil Media Thickness	18	inches
	5	Provided Gravel Storage Thickness	18	inches
	6	Hydromodification Orifice Diameter of Underdrain	0.8	inches
Biofiltration Calculations	7	Max Hydromod Flow Rate through Underdrain	0.033	CFS
	8	Max Soil Filtration Rate Allowed by Underdrain Orifice	0.25	in/hr
	9	Soil Media Filtration Rate	5.00	in/hr
	10	Soil Media Filtration Rate to be used for Sizing	0.25	in/hr
	11	Depth Biofiltered Over 6 Hour Storm	1.50	inches
	12	Soil Media Pore Space	0.30	-
	13	Gravel Pore Space	0.40	-
	14	Effective Depth of Biofiltration Storage	22.6	inches
	15	Drawdown Time for Surface Ponding	40	hours
	16	Drawdown Time for Entire Biofiltration Basin	90	hours
	17	Total Depth Biofiltered	24.10	inches
	18	Option 1 - Biofilter 1.50 DCV: Target Volume	5,031	cubic-feet
	19	Option 1 - Provided Biofiltration Volume	5,031	cubic-feet
	20	Option 2 - Store 0.75 DCV: Target Volume	2,516	cubic-feet
	21	Option 2 - Provided Storage Volume	2,516	cubic-feet
	22	Provided Capture for Biofiltration BMP	1.50	ratio
	23	**Biofiltration BMP Efficacy Factor for Use in WQE Formula**	1.00	ratio

*To meet the pollutant control requirements, the BMP design must be adjusted to drain the surface within 24 hours, while maintaining the original storage volume that would have been achieved within the 10 inches of ponding on the surface, and not exceeding the maximum allowable orifice flow rate. Adjust the design by decreasing the surface ponding and increasing the soil media thickness. For every 1 inch reduced from the surface ponding depth, the soil media thickness must be increased by 3.33 inches (1/0.3, where 0.3 is the porosity of the soil media). This changes the head over the orifice and changes the maximum flow rate through the underdrain, but still remains within the maximum limit of 0.04 cfs. With the new data for the biofiltration BMP area, ponding depth, media thickness, and flow rate, **Worksheet A.2** calculations below show the provided capture factor can still be maximized to 1.50. Therefore the biofiltration BMP can earn the same pollutant control credit calculated above in **Section 4.1.1**, 1,543 cubic feet.*

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Worksheet A.2: Biofiltration BMP Efficacy Factor Determination for Water Quality Equivalency				
Category	**#**	**Description**	**Value**	**Units**
BMP Inputs	0	Effective Tributary Area	50,312	sq-ft
	1	Design Capture Volume Tributary to BMP	3,354	cubic-feet
	2	Provided BMP Surface Area	5,663	sq-ft
	3	Provided Surface Ponding Depth	6	inches
	4	Provided Soil Media Thickness	32	inches
	5	Provided Gravel Storage Thickness	18	inches
	6	Hydromodification Orifice Diameter of Underdrain	0.8	inches
Biofiltration Calculations	7	Max Hydromod Flow Rate through Underdrain	0.036	CFS
	8	Max Soil Filtration Rate Allowed by Underdrain Orifice	0.28	in/hr
	9	Soil Media Filtration Rate	5.00	in/hr
	10	Soil Media Filtration Rate to be used for Sizing	0.28	in/hr
	11	Depth Biofiltered Over 6 Hour Storm	1.66	inches
	12	Soil Media Pore Space	0.30	-
	13	Gravel Pore Space	0.40	-
	14	Effective Depth of Biofiltration Storage	22.8	inches
	15	Drawdown Time for Surface Ponding	22	hours
	16	Drawdown Time for Entire Biofiltration Basin	83	hours
	17	Total Depth Biofiltered	24.46	inches
	18	Option 1 - Biofilter 1.50 DCV: Target Volume	5,031	cubic-feet
	19	Option 1 - Provided Biofiltration Volume	5,031	cubic-feet
	20	Option 2 - Store 0.75 DCV: Target Volume	2,516	cubic-feet
	21	Option 2 - Provided Storage Volume	2,516	cubic-feet
	22	Provided Capture for Biofiltration BMP	1.50	ratio
	23	**Biofiltration BMP Efficacy Factor for Use in WQE Formula**	1.00	ratio

4.2 Example 4-2: Regional BMPs

Problem Statement

A 20-acre fully developed drainage area consisting of multi-family housing, retail, retail/office, and roads land uses is tributary to a creek. The creek is un-lined and is susceptible to erosion. The various developments have been in place longer than stormwater regulations. There are no existing pollutant control or flow control BMPs serving the area. A property owner has obtained a 2-acre property that is currently developed but unoccupied (i.e., the retailer previously existing at the property is out of business and the existing building and associated parking are vacant). The property is located at the downstream end of the 20-acre drainage area, directly adjacent to the creek. The new property owner will use the entire 2-acre parcel they have obtained to construct an independent ACP. Design an ACP to provide pollutant control and hydromodification flow control benefits for the surrounding 18 acres. The desired structural BMP type is biofiltration. Assume that the structural BMP will include (from top layer to bottom layer): 10 inches of active storage ponding depth, 18 inches of bioretention soil media, and 18 inches of active storage in gravel drained by an underdrain, consistent with the structural BMP described in Appendix G.2.4 of the BMPDM. The biofiltration BMP will not include an impermeable liner at the bottom of the facility to prevent infiltration into underlying soils. However, there will be no dead storage in gravel below the facility underdrain, therefore the structural BMP will not meet requirements to be considered a retention BMP.

The following is the example problem data:

- *ACP Tributary Area: 20 acres (18 acres drains through the owner's 2-acre parcel)*
- *Watershed Management Area: Carlsbad*
- *85th Percentile Rainfall Depth: 0.8 inches*
- *Receiving Channel Susceptibility to Erosion: High*
- *Rain Gauge for Hydromodification Sizing Factor Calculations: Lake Wohlford*
- *NRCS Hydrologic Soil Group: D*
- *Slopes: Range from 1% to 2.5%*
- *Land Uses: See summary table below*

Land Use	Total Area (acres)	% Impervious	Impervious Area (acres)	Pervious Area (acres)
Retail	4.0	80%	3.2	0.8
Retail/Office	6.0	85%	5.1	0.9
Multi-Family Res	5.0	65%	3.25	1.75
Roads	3.0	90%	2.7	0.3
Retail	2.0	80%	1.6	0.4

Part I: WQE for Stormwater Pollutant Control

<u>Step 1: PDP Stormwater Pollutant Control Calculations</u>

This is an Independent ACP and information pertaining to a specific PDP is not available to the ACP applicant at this time. Therefore, this step is not applicable for this ACP.

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Step 2: ACP Stormwater Pollutant Control Calculations

The Earned Stormwater Pollutant Control Volume will be calculated per ***Equation 2-1***.

$V_E = L\ (\Delta V + V_2B_2 - V_1B_1)$

Where:

V_E: *Earned Stormwater Pollutant Control Volume* (ft^3)

L: Land Use Factor

ΔV: *Change in Design Capture Volume* ($V_1 - V_2$)

V_1: *Impacted Condition Design Capture Volume for ACP*

V_2: *Mitigated Condition Design Capture Volume for ACP*

B_1: *Impacted Condition BMP Efficacy Factor*

B_2: *Mitigated Condition BMP Efficacy Factor*

Task 2-1: Determine DCV Tributary to the ACP **(V_1, V_2, ΔV)**

In order to perform water quality equivalency calculations, the ACP applicant must determine the impacted condition DCV (V_1)*, the mitigated condition DCV* (V_2)*, and the change in DCV* (ΔV) *as presented below.*

Calculate Impacted Condition DCV (V_1)

The tributary area is calculated as 20.0 acres. Based on determination of the amount of existing impervious and pervious area in the ACP tributary (see the table of land uses in the example problem data), 15.85 acres are impervious and 4.15 acres are pervious. Using the method presented in Appendix B.1 of the BMPDM, where the impervious surface runoff coefficient is 0.9 and the pervious surface runoff coefficient is 0.1, the area-weighted average runoff coefficient in the existing condition is calculated to be 0.73. The average 85th percentile storm event depth for this tributary is determined to be 0.8 inches based on isopluvial maps (given in the example problem data). Therefore, the impacted condition DCV (V_1) *for this project is calculated as:*

V_1 = *Runoff Coefficient x Rainfall Depth x Tributary Area*

$V_1 = 0.73 \times 0.80\ in \times 20.0\ ac \times (43{,}560\ ft^2/1\ ac) \times (1\ ft/12\ in) = 42{,}398$ *cubic feet*

Calculate Mitigated Condition DCV (V_2)

The new property owner will use the entire 2-acre parcel they have obtained to construct the biofiltration BMP. The new owner intends to remove all of the existing impervious area within the 2-acre parcel (remove 1.6 acres existing impervious area). Therefore, the proposed condition tributary consists of less impervious area resulting in a lower area-weighted average runoff coefficient of 0.67. Therefore, the mitigated condition DCV (V_2) *for this project is calculated as:*

V_2 = *Runoff Coefficient x Rainfall Depth x Tributary Area*

$V_2 = 0.67 \times 0.80\ in \times 20.0\ ac \times (43{,}560\ ft^2/1\ ac) \times (1\ ft/12\ in) = 38{,}914$ *cubic feet*

Calculate Change in DCV (ΔV)

The impacted condition DCV is greater than the mitigated condition DCV; therefore, the change in DCV is calculated as:

$\Delta V = V_1 - V_2$

ΔV = *42,398 cubic feet – 38,914 cubic feet = 3,484 cubic feet*

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***Task 2-2: Calculate Land Use Factor** (L)*

In order to calculate an appropriate land use factor, the ACP applicant must identify the WQE pollutants of concern, calculate relative pollutant concentrations for the ACP tributary, and calculate relative pollutant concentrations for the reference tributary.

Task 2-2A: WQE Pollutants of Concern

*The ACP is identified to be within the Carlsbad WMA and hydrologic unit, so the WQE pollutants of concern are TSS, TP, TN, and FC per **Table 2-1** of this guidance.*

Task 2-2B: ACP Tributary Relative Pollutant Concentrations

The ACP tributary is characterized by the land uses identified in the example description above.

Task 2-2C: Reference Tributary Relative Pollutant Concentrations

*The reference tributary for an Independent ACP within the Carlsbad WMA is characterized by the land use composition values presented in **Table 2-3** of this guidance.*

Task 2-2D: Determine Land Use Factors

*The appropriate land use compositions and associated runoff factors are then tabulated into the input fields of **Worksheet A.5** and associated land use factors are calculated for each WQE pollutant of concern through utilization of **Equation 2-2**. This step may also be performed through utilization of the automated land use factor calculation tool available on www.projectcleanwater.org, as is demonstrated in this example. The lowest resulting land use factor is selected for incorporation into the stormwater pollutant reduction calculations. Therefore, the land use factor for this ACP is based on Total Suspended Solids (TSS) which equals 0.63 as depicted in **Worksheet A.5.***

Land Use Designation	ACP Tributary Characteristics		Reference Tributary Characteristics [2]		Relative Pollutant Concentrations by Land Use [3]						
	Area (Acres)	Runoff Factor [1]	Area (Acres)	Runoff Factor [1]	TSS	TP	TN	Tcu	TPb	TZn	FC
Agriculture	0.00	0.10	5,483.00	0.10	0.45	1.00	1.00	1.00	1.00	0.59	1.00
Commercial	12.00	0.80	4,403.00	0.80	0.13	0.16	0.16	0.56	0.48	1.00	0.87
Education	0.00	0.50	4,222.00	0.50	0.13	0.20	0.11	0.14	0.25	0.39	0.13
Industrial	0.00	0.90	4,887.00	0.90	0.13	0.19	0.15	0.54	0.68	0.89	0.49
Multi Family Residential	5.00	0.60	5,615.00	0.60	0.10	0.13	0.13	0.14	0.15	0.29	0.27
Orchard	0.00	0.10	2,831.00	0.10	0.18	0.17	0.67	1.00	1.00	0.59	0.11
Rural Residential	0.00	0.30	10,923.00	0.30	1.00	0.51	0.14	0.10	0.71	0.13	0.19
Single Family Residential	0.00	0.40	30,211.00	0.40	0.13	0.20	0.15	0.27	0.43	0.35	0.63
Transportation	3.00	0.90	15,156.00	0.90	0.11	0.26	0.12	0.53	0.31	0.62	0.12
Vacant / Open Space	0.00	0.10	0.00	0.10	0.16	0.10	0.10	0.12	0.10	0.10	0.10
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	20.00	-	83,731.00	-	-	-	-	-	-	-	-
	Relative Pollutant Concentration for ACP Tributary [4]				0.12	0.17	0.15	0.47	0.39	0.79	0.62
	Relative Pollutant Concentration for Reference Tributary [4]				0.19	0.24	0.15	0.39	0.42	0.53	0.39
	Watershed Management Area				Carlsbad						
	Hydrologic Unit				Carlsbad (904.00)						
	Land Use Factor [5]				**0.63**	**0.71**	**0.97**	-	-	-	**1.59**

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***Task 2-3: Calculate BMP Efficacy Factors** (B_{1}, B_{2})*

BMP efficacy factors are a function of an ACP's pollutant removal efficiency (Task 2-3a) and provided capture values (Task 2-3b). To perform water quality equivalency calculations, applicants must determine the impacted condition BMP efficacy factor (B_1), and the mitigated condition BMP efficacy factor (B_2).

Impacted Condition BMP Efficacy Factor (B_1)

The impacted condition of a regional BMP corresponds with the existing site conditions. There are no existing BMPs in this example; therefore, the impacted condition BMP efficacy factor (B_1) is 0.00

Mitigated Condition BMP Efficacy Factor (B_2)

*The mitigated condition of a regional BMP corresponds with site conditions anticipated after the ACP is completed. The ACP proposes to convert a 2-acre developed lot into a biofiltration BMP, so it will utilize **Equation 2-3** to calculate a BMP efficacy factor. The pollutant removal efficiency for biofiltration BMPs is 0.666, but the provided capture factor may vary with respect to the geometry of the proposed BMP. BMP size will be determined by using **Worksheet A.2** and selecting a size that will maximize the provided capture factor, which will maximize the BMP efficacy factor (B_2). Based on the BMPDM, the minimum biofiltration BMP size must be at least 3% of the area draining to the BMP after adjusting the area by the runoff factor.*

Minimum biofiltration size = 0.03 x 20 acres x 0.67 x 43,560 ft2 / acre = 17,512 square feet

*The mitigated condition BMP efficacy factor (B_2) will be calculated through the methodology presented in **Section 2.3.1.3.3** of this manual.*

1. *The ACP DCV was calculated to be 38,914 cubic feet in Step 2.1.*
2. *Using **Worksheet A.2** and entering the design parameters for surface ponding depth, soil media depth, and gravel depth provided in the example problem data, the BMP provided capture factor is maximized at 1.5 with the provided BMP surface area of **17,512** square feet. **Worksheet A.2** calculations are provided below.*
3. *The biofiltration BMP efficiency is maximized when analyzed using Option 1 (biofilter at least 1.5 times the portion of the DCV not reliable retained onsite). The provided biofiltration Volume is 58,371 cubic feet, or 100% of the target biofiltration volume for Option 1. The fraction of required biofiltration volume provided is 58,371 cubic feet (provided) / 58,371 cubic feet (target) = **1.0.***
4. *Determine the provided capture value: For biofiltration BMPs, the Provided Capture value is equivalent to the fraction of required biofiltration volume (Option 1) or storage volume (Option 2) that is provided (calculated in Step 3 above) multiplied by 1.50, with a maximum allowable value of 1.50. Therefore, the provided capture value = 1.0 x 1.50 = **1.50**.*
5. *The mitigated condition BMP efficacy factor for the proposed condition (B_2) can be calculated per **Equation 2-3**:*

   $B_2 = E \times C$

   Where:

   B_2: Mitigated Condition BMP Efficacy Factor
   *E: Pollutant Removal Efficiency (**Section 2.3.1.3.1**, E = 0.666)*
   *C: Provided Capture Factor (**Section 2.3.1.3.2.2**)*
   *B_2 = (0.666 x 1.50) = **1.00***

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Worksheet A.2: Biofiltration BMP Efficacy Factor Determination for Water Quality Equivalency

Category	#	Description	Value	Units
BMP Inputs	0	Effective Tributary Area	583,704	sq-ft
	1	Design Capture Volume Tributary to BMP	38,914	cubic-feet
	2	Provided BMP Surface Area	17,512	sq-ft
	3	Provided Surface Ponding Depth	10	inches
	4	Provided Soil Media Thickness	18	inches
	5	Provided Gravel Storage Thickness	18	inches
	6	Hydromodification Orifice Diameter of Underdrain	n/a	inches
Biofiltration Calculations	7	Max Hydromod Flow Rate through Underdrain	n/a	CFS
	8	Max Soil Filtration Rate Allowed by Underdrain Orifice	n/a	in/hr
	9	Soil Media Filtration Rate	5.00	in/hr
	10	Soil Media Filtration Rate to be used for Sizing	5.00	in/hr
	11	Depth Biofiltered Over 6 Hour Storm	30.00	inches
	12	Soil Media Pore Space	0.30	-
	13	Gravel Pore Space	0.40	-
	14	Effective Depth of Biofiltration Storage	22.6	inches
	15	Drawdown Time for Surface Ponding	2	hours
	16	Drawdown Time for Entire Biofiltration Basin	5	hours
	17	Total Depth Biofiltered	52.60	inches
	18	Option 1 - Biofilter 1.50 DCV: Target Volume	58,371	cubic-feet
	19	Option 1 - Provided Biofiltration Volume	58,371	cubic-feet
	20	Option 2 - Store 0.75 DCV: Target Volume	29,186	cubic-feet
	21	Option 2 - Provided Storage Volume	29,186	cubic-feet
	22	Provided Capture for Biofiltration BMP	1.50	ratio
	23	**Biofiltration BMP Efficacy Factor for Use in WQE Formula**	1.00	ratio

Task 2-4: Calculate Earned Stormwater Pollutant Control Volume ***(V_E)***

The Earned Stormwater Pollutant Control Volume for an ACP is calculated by populating ***Equation 2-1*** *with the appropriate volumes, land use factors and BMP efficacy factors determined per the guidelines set forth in* ***Section 2.3****. The Earned Stormwater Pollutant Control Volume for this ACP is calculated as:*

$V_E = L\ (\Delta V + V_2B_2 - V_1B_1)$

Where:

V_E*: Earned Stormwater Pollutant Control Volume* (ft^3)

$V_E = 0.63 \times [3{,}484 \text{ cubic feet} + (38{,}914 \text{ cubic feet} \times 1.0) - (42{,}398 \text{ cubic feet} \times 0.00)]$

$V_E = 26{,}711$ *cubic feet*

Step 3: Determination of Stormwater Pollutant Control Credits

An overall water quality benefit for stormwater pollutant control can be demonstrated if the Earned Stormwater Pollutant Control Volume calculated in Step 2 is greater than or equal to the Deficit of Stormwater Pollutant Control Volume calculated in Step 1. Because this is an Independent ACP, a volume has not yet been determined for Step 1.

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Therefore, Stormwater Pollutant Control Volume Credit of 26,711 cubic feet may be banked for potential future purchase by a PDP applicant with a Deficit of Stormwater Pollutant Control Volume of 26,711 cubic feet or less. Note that trading/selling of such credits is contingent on the approval of a credit system.

Part II: WQE for Hydromodification Flow Control

The hydromodification flow control example calculation will follow the steps presented in ***Section 3.5.2*** *of this WQE document. The sizing factor method presented in Chapter 6.3.5.1 and Appendix G.2 of the BMPDM will be used to determine a size for the ACP. In this example problem, references to "Appendix" or "Table" with a prefix of "G" refer to the BMPDM. Use of the sizing factor method in this example is not intended as an endorsement of the sizing factor method and should not imply that sizing factor method is required for ACP calculations. An ACP for hydromodification flow control may be sized based on project-specific continuous simulation modeling and may result in a different size than the ACP calculated in this example. The sizing factor method was selected because it is the simplest format to present in this WQE document.*

Step 1: Identify the drainage area draining to the ACP location

Based on the problem data provided, the total drainage area is 20 acres, consisting of 18 acres of offsite existing development plus the 2-acre parcel where the proposed ACP will be located.

Step 2: Directly measure the total existing DCIA within the ACP drainage area, or estimate using CA ISC and Sutherland EIA equations

Assume the impervious area presented above in the problem data was obtained by direct measurement. Assume that all of the impervious area has been determined to be DCIA based on a site visit to the drainage area. Assume nearly 100% of the 2-acre parcel will be utilized for the ACP. Within the 2-acre ACP parcel (onsite area), all of the existing impervious area will be removed. The total DCIA in the tributary drainage area (offsite area) is:

3.2 acres + 5.1 acres + 3.25 acres + 2.7 acres = 14.25 acres.

Step 3: Determine the receiving channel susceptibility to erosion (see Section 6 of the BMPDM)

The purpose of this step is to determine the fraction of Q2 to control for hydromodification management flow control design. Assume the receiving channel susceptibility to erosion has been determined to be high as given in the problem data. Therefore the low flow threshold for design is 0.1Q2 as required by the BMPDM.

Step 4: Using methods from the BMPDM in effect at the time of the development permit application for the ACP, design the ACP to mitigate up to 100% of the existing DCIA within the ACP drainage area

As stated above, the sizing factor method will be used for the example problem calculation. Based on Appendix G.2, this requires information describing the rainfall basin, hydrologic soil group, slope category, tributary drainage area, area-weighted runoff factor, and fraction of Q2 to control. All of this information has been given in the example problem data except the area-weighted runoff factor. Using methods presented in Appendix G.2, where the runoff factors are 1.0 for impervious area and 0.1 for pervious area for sizing factor method calculations, the area-weighted runoff factor is:

((14.25 acres impervious area x 1.0) + (5.75 acres pervious area x 0.1)) / 20 acres = 0.74

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Step 4.1 (Step 1 for sizing factor calculations)

The pre-development Q2 is determined based on the unit runoff ratio from Table G.2-2 multiplied by the total drainage area. The pre-development Q2 is then converted to the low flow threshold for hydromodification management flow control design by multiplying by the fraction of Q2 to control based on receiving channel susceptibility to erosion.

Based on Table G.2-2, the unit runoff ratio for Lake Wohlford rain gauge, soil group D, shrub cover (required cover category to represent pre-development condition), and low slope (between 0% to 5%), is 0.253 cfs/acre.

Pre-development Q2 = 20.0 acres x 0.253 cfs/acre = 5.1 cfs

Low flow threshold = 0.1Q2 = 0.1 x 5.06 cfs = 0.51 cfs

Step 4.2 (Step 2 for sizing factor calculations)

As shown in the problem statement, the desired structural BMP for this ACP is biofiltration, consistent with the structural BMP described in Appendix G.2.4. The area of the biofiltration BMP will be determined using the sizing factors from Table G.2-5.

Based on Table G.2-5, the area sizing factor for biofiltration for lower flow threshold 0.1Q2, soil group D, low slope (between 0% to 5%), Lake Wohlford rain gauge, is 0.100 (acre/acre).

Required area for biofiltration with partial retention = 20 acres x 0.74 x 0.100 = 1.48 acres

Note that this required area is based on assumed vertical sides from top to bottom, including in the active storage ponding area. When side slopes and maintenance access are added for the active storage ponding area, including consideration of additional depth (above the active storage ponding depth) in the ponding area for conveyance of larger storm events and freeboard, the structural BMP will occupy 100% of the 2-acre parcel.

Step 5 Determine ACP hydromodification flow control equivalency currency (existing DCIA mitigated)

*As shown in Step 4.2, the property owner will fit a structural BMP that is sized to provide hydromodification management flow control for the full tributary drainage area. Therefore the hydromodification flow control equivalency currency is the full amount of existing DCIA that will be mitigated by the ACP. The existing DCIA tributary to the ACP was calculated in Step 3: **14.25 acres**.*

Part III: WQE for Stormwater Pollutant Control and Hydromodification Flow Control

The structural BMP designed above for hydromodification management flow control can double as a pollutant control BMP because it provides biofiltration. For pollutant control calculations, assume that the required area shown above (1.48 acres) represents the area measured at the bottom of the active storage ponding area (the interface with the top of the bioretention soil media). The area of bioretention soil media will be 1.48 acres (64,469 square feet).

(Continued on next page)

Although the biofiltration BMP area calculated for hydromodification management flow control (64,469 square feet) is much greater than the BMP area calculated for pollutant control (17,512 square feet), it cannot be assumed that the same maximized BMP pollutant control credit is attained, because there will be a flow restrictor added for hydromodification management that will change the soil media filtration rate used in the pollutant control sizing calculations. Therefore a new pollutant control calculation must be performed.

*Use **Worksheet A.2** and enter the design parameters for surface ponding depth, soil media depth, and gravel depth provided in the example problem data, and 64,469 square feet for the provided BMP surface area. The soil media filtration rate to be used for sizing must be adjusted because the flow control orifice provided for hydromodification management will limit the flow through the soil. The low flow orifice must be designed to discharge 0.51 cfs. Select an orifice size that will discharge up to 0.51 cfs. The soil media filtration rate will be updated to match the design discharge rate of the low flow orifice (approximately 0.3 inches per hour as shown by the calculation below for an orifice discharge rate of 0.51 cfs).*

(0.51 cfs x 3,600 seconds/hour x 12 inches/foot) / 64,469 square feet = 0.3 inches / hour

*Selecting a 3.1-inch orifice provides an orifice flow rate just under 0.51 cfs. however, the BMP fails to drain the surface volume within 24 hours, a requirement for pollutant control design (see line 15 in **Worksheet A.2**, below).*

*To meet the pollutant control requirements, the BMP design must be adjusted to drain the surface within 24 hours, while maintaining the original storage volume that would have been achieved within the 10 inches of ponding on the surface, and not exceeding the maximum allowable orifice flow rate. Adjust the design by decreasing the surface ponding and increasing the soil media thickness. For every 1 inch reduced from the surface ponding depth, the soil media thickness must be increased by 3.33 inches (1/0.3, where 0.3 is the porosity of the soil media). This changes the head over the orifice and changes the maximum flow rate through the underdrain. To limit the outflow to a maximum of 0.51 cfs, the orifice size must be reduced to 3.0 inches. With the new data for the biofiltration BMP area, ponding depth, media thickness, and flow rate, **Worksheet A.2** calculations below show the provided capture factor can still be maximized to 1.50. Therefore the biofiltration BMP can earn the same pollutant control credit calculated above in **Section 4.1.1**, 26,711 cubic feet.*

(Continued on next page)

Worksheet A2 (Initial Parameters)

Worksheet A.2: Biofiltration BMP Efficacy Factor Determination for Water Quality Equivalency

Category	#	Description	Value	Units
BMP Inputs	0	Effective Tributary Area	583,704	sq-ft
	1	Design Capture Volume Tributary to BMP	38,914	cubic-feet
	2	Provided BMP Surface Area	64,469	sq-ft
	3	Provided Surface Ponding Depth	10	inches
	4	Provided Soil Media Thickness	18	inches
	5	Provided Gravel Storage Thickness	18	inches
	6	Hydromodification Orifice Diameter of Underdrain	3.1	inches
Biofiltration Calculations	7	Max Hydromod Flow Rate through Underdrain	0.486	CFS
	8	Max Soil Filtration Rate Allowed by Underdrain Orifice	0.33	in/hr
	9	Soil Media Filtration Rate	5.00	in/hr
	10	Soil Media Filtration Rate to be used for Sizing	0.33	in/hr
	11	Depth Biofiltered Over 6 Hour Storm	1.95	inches
	12	Soil Media Pore Space	0.30	-
	13	Gravel Pore Space	0.40	-
	14	Effective Depth of Biofiltration Storage	22.6	inches
	15	Drawdown Time for Surface Ponding	31	hours
	16	Drawdown Time for Entire Biofiltration Basin	69	hours
	17	Total Depth Biofiltered	24.55	inches
	18	Option 1 - Biofilter 1.50 DCV: Target Volume	58,371	cubic-feet
	19	Option 1 - Provided Biofiltration Volume	58,371	cubic-feet
	20	Option 2 - Store 0.75 DCV: Target Volume	29,186	cubic-feet
	21	Option 2 - Provided Storage Volume	29,186	cubic-feet
	22	Provided Capture for Biofiltration BMP	1.50	ratio
	23	**Biofiltration BMP Efficacy Factor for Use in WQE Formula**	1.00	ratio

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Worksheet A2 (Optimized for Pollutant Control)

Worksheet A.2: Biofiltration BMP Efficacy Factor Determination for Water Quality Equivalency

Category	#	Description	Value	Units
BMP Inputs	0	Effective Tributary Area	583,704	sq-ft
	1	Design Capture Volume Tributary to BMP	38,914	cubic-feet
	2	Provided BMP Surface Area	64,469	sq-ft
	3	Provided Surface Ponding Depth	7	inches
	4	Provided Soil Media Thickness	28	inches
	5	Provided Gravel Storage Thickness	18	inches
	6	Hydromodification Orifice Diameter of Underdrain	3.0	inches
Biofiltration Calculations	7	Max Hydromod Flow Rate through Underdrain	0.490	CFS
	8	Max Soil Filtration Rate Allowed by Underdrain Orifice	0.33	in/hr
	9	Soil Media Filtration Rate	5.00	in/hr
	10	Soil Media Filtration Rate to be used for Sizing	0.33	in/hr
	11	Depth Biofiltered Over 6 Hour Storm	1.97	inches
	12	Soil Media Pore Space	0.30	-
	13	Gravel Pore Space	0.40	-
	14	Effective Depth of Biofiltration Storage	22.6	inches
	15	Drawdown Time for Surface Ponding	21	hours
	16	Drawdown Time for Entire Biofiltration Basin	69	hours
	17	Total Depth Biofiltered	24.57	inches
	18	Option 1 - Biofilter 1.50 DCV: Target Volume	58,371	cubic-feet
	19	Option 1 - Provided Biofiltration Volume	58,371	cubic-feet
	20	Option 2 - Store 0.75 DCV: Target Volume	29,186	cubic-feet
	21	Option 2 - Provided Storage Volume	29,186	cubic-feet
	22	Provided Capture for Biofiltration BMP	1.50	ratio
	23	**Biofiltration BMP Efficacy Factor for Use in WQE Formula**	1.00	ratio

4.3 Example 4-3: Water Supply BMPs

Problem Statement

An Independent ACP applicant elects to install a large underground cistern within an area of existing development to capture stormwater runoff for onsite use as well as generate water quality and HMP credits for participation in a credit system or in-lieu fee program. The project is located in the San Diego River WMA and the ACP tributary consists of 10 acres of urbanized area with the following land uses; 20% Single Family Residential, 25% Commercial, 10% Industrial, 10% Transportation, 25% Multi Family Residential and 10% Vacant/Open Space. The applicant proposes to install a large underground cistern with a capacity significantly larger than the tributary DCV. The lower portion of the cistern will accommodate the entire DCV and lower section outlet will be a line capable of drawing down the DCV within 36 hours. The water will be pumped to a raw potable water supply reservoir for storage prior to treatment and use by the local water district. The upper portions of the cistern will be outfitted with a series of orifices to allow larger hydromodification events to be discharged at flows and durations that match predevelopment conditions. The 85th percentile rainfall depth at this location is 0.77" and an impacted condition runoff coefficient of the tributary area is 0.60.

The 10 acre drainage area draining to the proposed ACP includes the following land uses: 20% Single Family Residential, 25% Commercial, 10% Industrial, 10% Transportation, 25% Multi Family Residential and 10% Vacant/Open Space. Thus:

- *2 acres single-family residential*
- *2.5 acres commercial*
- *1 acre industrial*
- *1 acre road right-of-way*
- *2.5 multi-family housing with 10 dwelling units per acre (DU/A)*
- *1 acre open space*

Part I: WQE for Stormwater Pollutant Control

<u>Step 1: PDP Stormwater Pollutant Control Calculations</u>

This is an Independent ACP and information pertaining to a specific PDP is not available to the ACP applicant at this time. Therefore, this step is not applicable for this ACP.

<u>Step 2: ACP Stormwater Pollutant Control Calculations</u>

*The Earned Stormwater Pollutant Control Volume will be calculated per **<u>Equation 2-1</u>**.*

$V_E = L\ (\Delta V + V_2B_2 - V_1B_1)$

<u>Where:</u>

V_E: Earned Stormwater Pollutant Control Volume (ft^3)

L: Land Use Factor

ΔV: Change in Design Capture Volume ($V_1 - V_2$)

V_1: Impacted Condition Design Capture Volume for ACP

V_2: Mitigated Condition Design Capture Volume for ACP

B_1: Impacted Condition BMP Efficacy Factor

B_2: Mitigated Condition BMP Efficacy Factor

(Continued on next page)

<u>Task 2-1: Calculate DCV Tributary to the ACP</u> (V_1, V_2, ΔV)

In order to perform water quality equivalency calculations, the ACP applicant must determine the impacted condition DCV (V_1), the mitigated condition DCV (V_2), and the change in DCV (ΔV) as presented below.

<u>Calculate Impacted Condition DCV</u> (V_1)

The applicant delineates an ACP tributary area of 10 acres, identifies an 85th percentile rainfall depth of 0.77", and determines the impacted condition runoff coefficient of 0.60. Therefore, the impacted condition DCV (V_1) for this project is calculated as:

$$V_1 = \text{Runoff Coefficient} \times \text{Rainfall Depth} \times \text{Tributary Area}$$

$$V_1 = 0.60 \times 0.77 \text{ in} \times 10 \text{ ac} \times (43{,}560 \text{ ft}^2/1 \text{ ac}) \times (1 \text{ ft}/12 \text{ in}) = 16{,}770 \text{ cubic feet}$$

<u>Calculate Mitigated Condition DCV</u> (V_2)

The proposed ACP does not alter runoff coefficients within the ACP tributary; therefore, the mitigated condition DCV is equal to the impacted condition DCV ($V_1 = V_2$).

$$V_2 = \text{Runoff Coefficient} \times \text{Rainfall Depth} \times \text{Tributary Area}$$

$$V_2 = 0.60 \times 0.77 \text{ in} \times 10 \text{ ac} \times (43{,}560 \text{ ft}^2/1 \text{ ac}) \times (1 \text{ ft}/12 \text{ in}) = 16{,}770 \text{ cubic feet}$$

<u>Calculate Change in DCV</u> (ΔV)

The impacted condition DCV and the mitigated condition DCV are equal; therefore, the change in DCV is equal to zero.

$$\Delta V = V_1 - V_2$$

$$\Delta V = 0 \text{ cubic feet}$$

<u>Task 2-2: Calculate Land Use Factor</u> (L)

To calculate a land use factor, the applicant must identify the WQE pollutants of concern, relative pollutant concentrations for the ACP tributary, and relative pollutant concentrations for the reference tributary.

<u>Task 2-2A: WQE Pollutants of Concern</u>

*The ACP is identified to be within the San Diego River WMA and hydrologic unit, so the WQE pollutants of concern are TP, TN, and FC per **<u>Table 2-1</u>** of this guidance.*

<u>Task 2-2B: ACP Tributary Relative Pollutant Concentrations</u>

The ACP tributary is characterized by the land uses identified in the example description above.

<u>Task 2-2C: Reference Tributary Relative Pollutant Concentrations</u>

*The reference tributary for an Independent ACP within the San Diego River WMA is characterized by the land use composition values presented in **<u>Table 2-3</u>** of this guidance.*

<u>Task 2-2D: Determine Land Use Factors</u>

*The appropriate land use compositions and associated runoff factors are then tabulated into the input fields of **<u>Worksheet A.5</u>** and associated land use factors are calculated for each WQE pollutant of concern through utilization of **<u>Equation 2-2</u>**. This step may also be performed through utilization of the automated land use factor calculation tool available on www.projectcleanwater.org, as is demonstrated in this example. The lowest resulting land use factor is selected for incorporation into the stormwater pollutant reduction calculations. Therefore, the land use factor for this ACP is based on Total Phosphorus (TP) which equals 0.68 as depicted in the figure below.*

(Continued on next page)

Land Use Designation	ACP Tributary Characteristics		Reference Tributary Characteristics [2]		Relative Pollutant Concentrations by Land Use [3]						
	Area (Acres)	Runoff Factor [1]	Area (Acres)	Runoff Factor [1]	TSS	TP	TN	Tcu	TPb	TZn	FC
Agriculture	0.00	0.10	2,816.00	0.10	0.45	1.00	1.00	1.00	1.00	0.59	1.00
Commercial	2.50	0.80	4,043.00	0.80	0.13	0.16	0.16	0.56	0.48	1.00	0.87
Education	0.00	0.50	5,159.00	0.50	0.13	0.20	0.11	0.14	0.25	0.39	0.13
Industrial	1.00	0.90	3,660.00	0.90	0.13	0.19	0.15	0.54	0.68	0.89	0.49
Multi Family Residential	2.50	0.60	4,979.00	0.60	0.10	0.13	0.13	0.14	0.15	0.29	0.27
Orchard	0.00	0.10	1,060.00	0.10	0.18	0.17	0.67	1.00	1.00	0.59	0.11
Rural Residential	0.00	0.30	18,073.00	0.30	1.00	0.51	0.14	0.10	0.71	0.13	0.19
Single Family Residential	2.00	0.40	24,131.00	0.40	0.13	0.20	0.15	0.27	0.43	0.35	0.63
Transportation	1.00	0.90	13,822.00	0.90	0.11	0.26	0.12	0.53	0.31	0.62	0.12
Vacant / Open Space	1.00	0.10	0.00	0.10	0.16	0.10	0.10	0.12	0.10	0.10	0.10
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	10.00	-	77,743	-	-	-	-	-	-	-	-
	Relative Pollutant Concentration for ACP Tributary [4]				0.12	0.18	0.14	0.41	0.39	0.66	0.52
	Relative Pollutant Concentration for Reference Tributary [4]				0.24	0.26	0.14	0.36	0.43	0.50	0.36
	Watershed Management Area				San Diego River						
	Hydrologic Unit				San Diego (907.00)						
	Land Use Factor [5]				-	**0.68**	**1.00**	-	-	-	**1.43**

***Task 2-3: Calculate BMP Efficacy Factors** (B_1, B_2)*

BMP efficacy factors are a function of an ACP's pollutant removal efficiency (Task 2-3a) and provided capture values (Task 2-3b). In order to perform water quality equivalency calculations, the applicant must determine the impacted condition BMP efficacy factor (B_1), and the mitigated condition BMP efficacy factor (B_2) for the ACP.

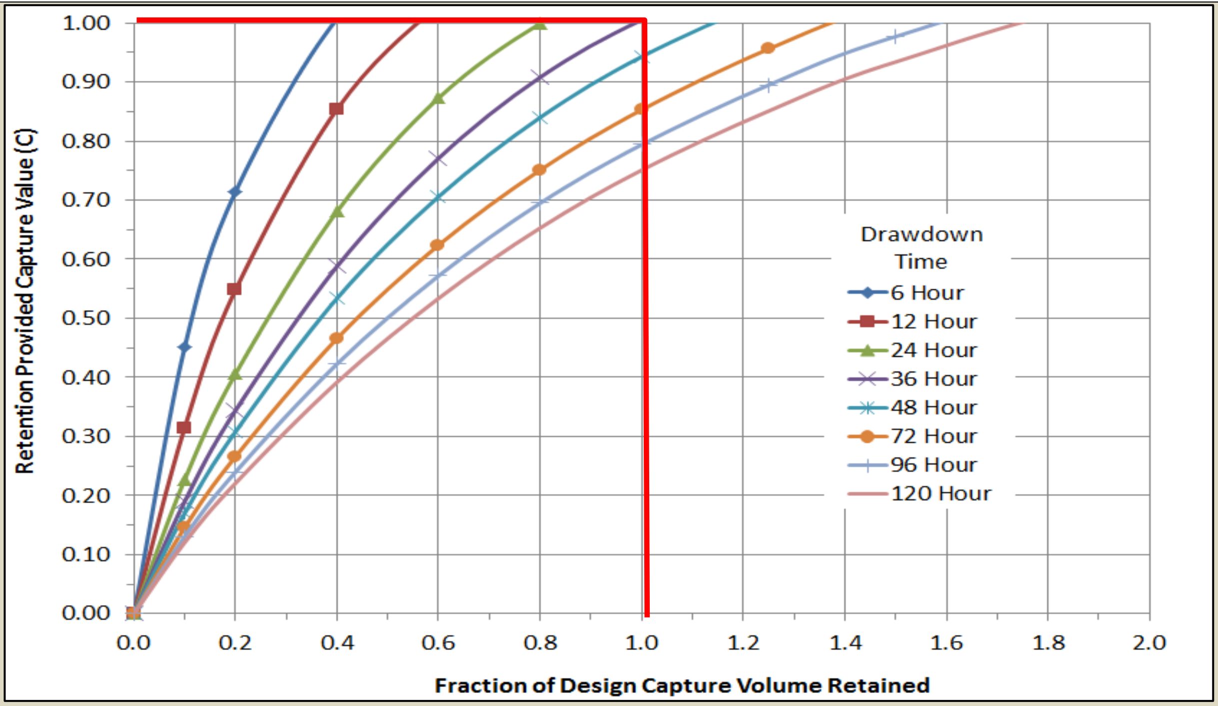
Impacted Condition BMP Efficacy Factor (B_1)

The impacted condition of a water supply BMP corresponds with the existing site conditions. There are no existing BMPs in this example; therefore, the impacted condition BMP efficacy factor (B_1) is 0.00

Mitigated Condition BMP Efficacy Factor (B_2)

*The mitigated condition of a water supply BMP corresponds with site conditions anticipated after the ACP is completed. The appropriate BMP efficacy factor will be determined per the retention-based guidelines identified in **Section 2.3.1.3.3**. Retention-based BMPs have a pollutant removal efficiency of 1.00; therefore, the ultimate BMP efficacy factor is simply a function of the provided capture of the proposed BMP. Using the provided capture curves for retention BMPs provided in **Section 2.3.1.3.2.1**, the applicant identifies that the proposed cistern will capture the full DCV and drawdown (in this case use) within 36 hours, resulting in a provided capture value of 1.00 per the graphic at right.*

(Continued on next page)



*The mitigated condition BMP efficacy factor (B_2) can be calculated per **Equation 2-3** as:*

$B_2 = E \times C$

Where:

B_2: Mitigated Condition BMP Efficacy Factor

*E: Pollutant Removal Efficiency (**Section 2.3.1.3.1**, E = 1.00)*

*C: Provided Capture Factor (**Section 2.3.1.3.2.1**)*

B_2 = (1.00 x 1.00) = 1.00

Task 2.4: Calculate Earned Stormwater Pollutant Control Volume (V_E)

*The Earned Stormwater Pollutant Control Volume for an ACP is calculated by populating **Equation 2-1** with the appropriate volumes, land use factors and BMP efficacy factors determined per the guidelines set forth in **Section 2.3**. The Earned Stormwater Pollutant Control Volume for this ACP is calculated as:*

$V_E = L\,(\Delta V + V_2B_2 - V_1B_1)$

$V_E = 0.68 \times [0 + (16{,}770 \times 1.00) - (16{,}700 \times 0.00)]$

V_E = 11,400 cubic feet

Step 3: Determination of Stormwater Pollutant Control Credits

An overall water quality benefit for stormwater pollutant control can be demonstrated if the Earned Stormwater Pollutant Control Volume calculated in Step 2 above is greater than or equal to the Deficit of Stormwater Pollutant Control Volume calculated in Step 1. Because this is an Independent ACP, a volume has not yet been determined for Step 1. Therefore, Stormwater Pollutant Control Volume Credit of 11,400 cubic feet may be banked for potential future purchase by a PDP applicant with a Deficit of Stormwater Pollutant Control Volume of 11,400 cubic feet or less. Note that trading/selling of such credits is contingent on the approval of a credit system.

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Part II: WQE for Hydromodification Flow Control

The applicant elects to perform a direct measurement of DCIA tributary and the following data is obtained from direct measurement from aerial photographs combined with field observations of the drainage area:

- *2 acres single-family residential contains 1 acre impervious area, all directly connected*
- *2.5 acres commercial contains 2 acres existing impervious area, all directly connected*
- *1 acre industrial contains 0.8 acres existing impervious area, all directly connected*
- *1 acre road right-of-way contains 0.8 acres existing impervious area, all directly connected*
- *2.5 multi-family housing with 1.5 dwelling units per acre (DU/A) contains 2 acres existing impervious area, all directly connected*
- *1 acre open space contains 0 acres existing impervious area*

Additional project information needed for HMP calculations is as follows:

- *Receiving channel susceptibility to erosion for hydromodification management flow control sizing: high*
- *This San Diego River watershed project falls within the basin best represented by the Oceanside rain gauge.*
- *NRCS hydrologic soil types throughout the total drainage area: NRCS hydrologic soil group D*
- *Approximate slopes throughout the total drainage area: ranges from 1% to 2.5%*

*The water supply BMP hydromodification flow control example calculation will follow the steps presented in **Section 3.5.2**. The sizing factor method presented in Chapter 6.3.5.1 and Appendix G.2 of the BMPDM will be used to determine a size for the ACP. References to "Appendix" or "Table" with a prefix of "G" refer to the Model BMP Design Manual. Use of the sizing factor method in this example is not intended as an endorsement of the sizing factor method and should not imply that sizing factor method is required for ACP calculations. An ACP for hydromodification flow control may be sized based on project-specific continuous simulation modeling and may result in a different size than the ACP calculated in this example. The sizing factor method was selected because it is the simplest format to present in this WQE document.*

Step 1: Identify the drainage area draining to the ACP location

Based on the problem data provided, the total drainage area is 10 acres as previously described.

Step 2: Directly measure the total existing DCIA within the ACP drainage area, or estimate using CA ISC and Sutherland EIA equations

Assume the impervious area presented above in the problem data was obtained by direct measurement. The cistern will be located underground and will not change the existing imperviousness of the area. The total DCIA in the tributary drainage area (offsite area) is:

1 acre + 2 acres + 0.8 acres + 0.8 acres + 2 acres + 0 acres = 6.6 acres.

Step 3: Determine the receiving channel susceptibility to erosion (see Section 6 of the BMP Design Manual)

The purpose of this step is to determine the fraction of Q2 to control for hydromodification management flow control design. Assume the receiving channel susceptibility to erosion has been determined to be high as given in the problem data. Therefore the low flow threshold for design is 0.1Q2 as required by the Model BMP Design Manual.

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Step 4: Using methods from the BMP Design Manual in effect at the time of the development permit application for the ACP, design the ACP to mitigate up to 100% of the existing DCIA within the ACP drainage area

As stated above, the sizing factor method will be used for the example problem calculation. Based on Appendix G.2, this requires information describing the rainfall basin, hydrologic soil group, slope category, tributary drainage area, area-weighted runoff factor, and fraction of Q2 to control. All of this information has been given in the example problem data except the area-weighted runoff factor. Using methods presented in Appendix G.2, where the runoff factors are 1.0 for impervious area and 0.1 for pervious area for sizing factor method calculations, the area-weighted runoff factor is:

((6.6 acres impervious area x 1.0) + (3.4 acres pervious area x 0.1)) / 10 acres = 0.69

Step 4.1 (Step 1 for sizing factor calculations)

The pre-development Q2 is determined based on the unit runoff ratio from Table G.2-2 multiplied by the total drainage area. The pre-development Q2 is then converted to the low flow threshold for hydromodification management flow control design by multiplying by the fraction of Q2 to control based on receiving channel susceptibility to erosion.

Based on Table G.2-2, the unit runoff ratio for Oceanside rain gauge, soil group D, shrub cover (required cover category to represent pre-development condition), and low slope (between 0% to 5%), is 0.175 cfs/acre.

Pre-development Q2 = 10.0 acres x 0.175 cfs/acre = 1.75 cfs

Low flow threshold = 0.1Q2 = 0.1 x 1.75 cfs = 0.175 cfs

Step 4.2 (Step 2 for sizing factor calculations)

As shown in the problem statement, the desired structural BMP for this ACP is an underground cistern, consistent with the structural BMP described in Appendix G.2.6. The volume of the BMP will be determined using the sizing factors from Table G.2-7.

Based on Table G.2-7, the volume sizing factor for a cistern for lower flow threshold 0.1Q2, soil group D, low slope (between 0% to 5%), Oceanside rain gauge, is 0.200 (cubic feet/square feet). Convert acres to square feet.

Area = 10 acres = 435,600 square feet

Required volume for a cistern = 435,600 square feet x 0.69 x 0.200 = 60,113 cubic feet

The cistern required for full HMP equivalency credit would have a volume of 60,113 cubic feet.

Step 5 Determine ACP hydromodification flow control equivalency currency (existing DCIA mitigated)

For stormwater pollutant control, the property owner is installing a cistern to contain the impacted condition DCV of 16,770 cubic feet. Comparing this to the DCIA calculated in Step 2 and the requirement for a cistern in Step 5 provides the following result:

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Potential Credit = (16,770 cubic feet/60,113 cubic feet) x 6.6 acres = 1.84 acres

For this example, the potential hydromodification flow control equivalency currency is 1.84 acres. If this ACP meets the specific location requirements for a PDP, the credits can potentially be sold or traded.

Part III: WQE for Stormwater Pollutant Control and Hydromodification Flow Control

The underground cistern proposed in this example is designed such that the cistern's stormwater pollutant control elements and hydromodification flow control elements operate independently of each other. To elaborate, incorporation of hydromodification flow control elements into the proposed cistern do not alter the manner in which the DCV enters or leaves the proposed underground cistern.

4.4 Example 4-4: Land Restoration NSMPs

Problem Statement

An Independent ACP applicant seeking to earn stormwater pollutant control and hydromodification flow control credits elects to restore 10 acres of existing development back to a stable, predevelopment condition in perpetuity. The existing development consists of 20% Single Family Residential, 25% Commercial, 10% Industrial, 10% Transportation, 25% Multi Family Residential and 10% Vacant/Open Space land uses. The parcel is located in the Carlsbad watershed management area hydrologic unit. The 85th percentile rainfall depth at this location is 0.77" and the pre-project combined runoff coefficient is 0.60; the water quality credits for the project can be calculated as demonstrated below.

Part I: WQE for Stormwater Pollutant Control

Step 1: PDP Stormwater Pollutant Control Calculations

This is an Independent ACP and information pertaining to a specific PDP is not available to the ACP applicant at this time. Therefore, this step is not applicable for this ACP.

Step 2: ACP Stormwater Pollutant Control Calculations

*The Earned Stormwater Pollutant Control Volume will be calculated per **Equation 2-1**.*

$V_E = L\ (\Delta V + V_2B_2 - V_1B_1)$

Where:

V_E: Earned Stormwater Pollutant Control Volume (ft^3)
L: Land Use Factor
ΔV: Change in Design Capture Volume ($V_1 - V_2$)
V_1: Impacted Condition Design Capture Volume for ACP
V_2: Mitigated Condition Design Capture Volume for ACP
B_1: Impacted Condition BMP Efficacy Factor
B_2: Mitigated Condition BMP Efficacy Factor

Task 2-1: Calculate DCV Tributary to the ACP (V_1, V_2, ΔV)

In order to perform water quality equivalency calculations, the ACP applicant must determine the impacted condition DCV (V_1), the mitigated condition DCV (V_2), and the change in DCV (ΔV) as presented below.

Calculate Impacted Condition DCV (V_1)

The applicant delineates an ACP tributary area of 10 acres, identifies an 85th percentile rainfall depth of 0.77", and determines that impacted condition does not provide any retention. Per methods presented in Appendix B.1 of the BMPDM, the area weighted average runoff coefficient is calculated to be 0.60 based on its mix of land uses. Therefore, the impacted condition DCV (V_1) for this project is calculated as:

V_1 = Runoff Coefficient x Rainfall Depth x Tributary Area
$V_1 = 0.60 \times 0.77 \text{ in} \times 10.00 \text{ ac} \times (43{,}560 \text{ ft}^2/1 \text{ ac}) \times (1 \text{ foot}/12 \text{ in}) = 16{,}771$ cubic feet

Calculate Mitigated Condition DCV (V_2)

The proposed ACP will restore existing developed land back to a stable, predevelopment condition with a mitigated runoff coefficient of C=0.10 (native vegetation, no impervious surfaces, current site grades). Therefore, the mitigated condition DCV (V_2) for this project is calculated as:

(Continued on next page)

V_2 = Runoff Coefficient x Rainfall Depth x Tributary Area

V_2 = 0.10 x 0.77 in x 10.00 ac x (43,560 ft^2 /1 ac) x (1 foot/12 in) = 2,795 cubic feet

Calculate Change in DCV (ΔV)

The impacted condition DCV is greater than the mitigated condition DCV; therefore, the change in DCV is calculated as:

$\Delta V = V_1 - V_2$

ΔV = 16,771 cubic feet – 2,795 cubic feet = 13,976 cubic feet

***Task 2-2: Calculate Land Use Factor** (L)*

In order to calculate an appropriate land use factor, the ACP applicant must identify the WQE pollutants of concern, calculate relative pollutant concentrations for the ACP tributary, and calculate relative pollutant concentrations for the reference tributary.

Task 2-2A: WQE Pollutants of Concern

*The ACP is identified to be within the Carlsbad WMA and hydrologic unit, so the WQE pollutants of concern are TSS, TP, TN, and FC per **Table 2-1** of this guidance.*

Task 2-2B: ACP Tributary Relative Pollutant Concentrations

The ACP tributary is characterized by the land uses identified in the example description above.

Task 2-2C: Reference Tributary Relative Pollutant Concentrations

*The reference tributary for an Independent ACP within the Carlsbad WMA is characterized by the land use composition values presented in **Table 2-3** of this guidance.*

Task 2-2D: Determine Land Use Factors

*The appropriate land use compositions and associated runoff factors are then tabulated into the input fields of **Worksheet A.5** and associated land use factors are calculated for each WQE pollutant of concern through utilization of **Equation 2-2**. This step may also be performed through utilization of the automated land use factor calculation tool available on www.projectcleanwater.org, as is demonstrated in this example. The lowest resulting land use factor is selected for incorporation into the stormwater pollutant reduction calculations. Therefore, the land use factor for this ACP is based on Total Suspended Solids (TSS) which equals 0.50 as depicted in the figure below.*

(Continued on next page)

Land Use Designation	ACP Tributary Characteristics		Reference Tributary Characteristics [2]		Relative Pollutant Concentrations by Land Use [3]						
	Area (Acres)	Runoff Factor [1]	Area (Acres)	Runoff Factor [1]	TSS	TP	TN	Tcu	TPb	TZn	FC
Agriculture	0.00	0.10	2,816.00	0.10	0.45	1.00	1.00	1.00	1.00	0.59	1.00
Commercial	2.50	0.80	4,043.00	0.80	0.13	0.16	0.16	0.56	0.48	1.00	0.87
Education	0.00	0.50	5,159.00	0.50	0.13	0.20	0.11	0.14	0.25	0.39	0.13
Industrial	1.00	0.90	3,660.00	0.90	0.13	0.19	0.15	0.54	0.68	0.89	0.49
Multi Family Residential	2.50	0.60	4,979.00	0.60	0.10	0.13	0.13	0.14	0.15	0.29	0.27
Orchard	0.00	0.10	1,060.00	0.10	0.18	0.17	0.67	1.00	1.00	0.59	0.11
Rural Residential	0.00	0.30	18,073.00	0.30	1.00	0.51	0.14	0.10	0.71	0.13	0.19
Single Family Residential	2.00	0.40	24,131.00	0.40	0.13	0.20	0.15	0.27	0.43	0.35	0.63
Transportation	1.00	0.90	13,822.00	0.90	0.11	0.26	0.12	0.53	0.31	0.62	0.12
Vacant / Open Space	1.00	0.10	0.00	0.10	0.16	0.10	0.10	0.12	0.10	0.10	0.10
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	10.00	-	77,743	-	-	-	-	-	-	-	-
	Relative Pollutant Concentration for ACP Tributary [4]				0.12	0.18	0.14	0.41	0.39	0.66	0.52
	Relative Pollutant Concentration for Reference Tributary [4]				0.24	0.26	0.14	0.36	0.43	0.50	0.36
	Watershed Management Area				Carlsbad						
	Hydrologic Unit				Carlsbad (904.00)						
	Land Use Factor [5]				**0.50**	**0.68**	**1.00**	-	-	-	**1.43**

Task 2-3: Calculate BMP Efficacy Factors ***(B_1, B_2)***

BMP efficacy factors are a function of an ACP's pollutant removal efficiency (Task 2-3a) and provided capture values (Task 2-3b). To perform water quality equivalency calculations, applicants must determine the impacted condition BMP efficacy factor (B_1), and the mitigated condition BMP efficacy factor (B_2).

Impacted Condition BMP Efficacy Factor (B_1)

The impacted condition of a land restoration NSMP corresponds with the existing site conditions. There are no existing BMPs in this example; therefore, the impacted condition BMP efficacy factor (B_1) =0.00.

Mitigated Condition BMP Efficacy Factor (B_2)

Land restoration is implemented to restore predevelopment watershed functions in lieu of providing direct management of stormwater pollutant control and hydromodification flow control. NSMPs may include structural/engineered elements, but these elements do not expressly provide stormwater pollutant control benefits. The mitigated condition BMP efficacy factor (B_2) is equal to the impacted condition BMP efficacy factor (0.00).

Task 2-4: Calculate Earned Stormwater Pollutant Control Volume ***(V_E)***

*The Earned Stormwater Pollutant Control Volume for an ACP is calculated by populating **Equation 2-1** with the appropriate volumes, land use factors, and BMP efficacy factors determined per the guidelines set forth in **Section 2.3**. The Earned Stormwater Pollutant Control Volume for this ACP is calculated as:*

$V_E = L\ (\Delta V + V_2B_2 - V_1B_1)$

$V_E = 0.50 \times [13{,}976 + (2{,}795 \times 0.00) - (16{,}771 \times 0.00)]$

$V_E = 6{,}988$ *cubic feet*

(Continued on next page)

Step 3: Determination of Stormwater Pollutant Control Credits

An overall water quality benefit for stormwater pollutant control can be demonstrated if the Earned Stormwater Pollutant Control Volume calculated in Step 2 is greater than or equal to the Deficit of Stormwater Pollutant Control Volume calculated in Step 1. Because this is an Independent ACP, a volume has not yet been determined for Step 1. Therefore, Stormwater Pollutant Control Volume Credit of 6,988 cubic feet may be banked for potential future purchase by a PDP applicant with a Deficit of Stormwater Pollutant Control Volume of 6,988 cubic feet or less. Note that trading/selling of such credits is contingent on the approval of a credit system.

Example 4.4 - Part II: WQE for Hydromodification Flow Control

Hydromodification flow control equivalency would be expected where existing developed land (impacted condition) is restored or rehabilitated to an undeveloped/natural state (mitigated condition), and land use restrictions are enacted to prevent future impervious area on the preserved area.

An applicant elects to perform a direct measurement of DCIA tributary to their project as described below. Per the example outline presented above, a 10 acre drainage area draining to a proposed ACP includes the following land uses: 20% Single Family Residential, 25% Commercial, 10% Industrial, 10% Transportation, 25% Multi Family Residential and 10% Vacant/Open Space. Thus:

- *2 acres single-family residential*
- *2.5 acres commercial*
- *1 acre industrial*
- *1 acre road right-of-way*
- *2.5 multi-family housing with 10 dwelling units per acre*
- *1 acre open space*

The following data is obtained from direct measurement from aerial photographs combined with field observations of the drainage area:

- *2 acres single-family residential contains 1 acre impervious area, all directly connected*
- *2.5 acres commercial contains 2 acres existing impervious area, all directly connected*
- *1 acre industrial contains 0.8 acres existing impervious area, all directly connected*
- *1 acre road right-of-way contains 0.8 acres existing impervious area, all directly connected*
- *2.5 multi-family housing with 1.5 dwelling units per acre contains 2 acres existing impervious area, all directly connected*
- *1 acre open space contains 0 acres existing impervious area*

The total impervious area of the developed site is 6.1 acres and is all directly connected. The ACP can earn credit for mitigating up to 6.1 acres of existing DCIA when the project area is returned to undeveloped space with no impervious surfaces.

Example 4.4 - Part III: WQE for Stormwater Pollutant Control and Hydromodification Flow Control

This land restoration NSMP example shows how the same project achieves both a reduction in runoff of the water quality design control volume and a reduction in directly connected impervious surface, which meets both water quality and HMP credit generating criteria.

4.5 Example 4-5: Land Preservation NSMPs

Problem Statement

An Independent ACP applicant seeking to earn stormwater pollutant control and hydromodification flow control credits elects to preserve an existing 4,900 square foot (0.11 acre) undeveloped parcel that is zoned for commercial development. The parcel is located in the San Diego River WMA and hydrologic unit. Based on examination available mapping, the purchased parcel is approved for commercial land use, is anticipated to be entirely impervious in its future developed condition, and does not directly discharge to an environmentally sensitive area; therefore, it is determined that the future commercial development would not trigger PDP thresholds. Assuming an 85th percentile rainfall depth of 0.6", a pavement runoff factor of 1.00, and a landscape runoff factor of 0.1, the water quality credits for the project can be calculated as demonstrated below.

Part I: WQE for Stormwater Pollutant Control

<u>Step 1: PDP Stormwater Pollutant Control Calculations</u>

This is an Independent ACP and information pertaining to a specific PDP is not available to the ACP applicant at this time. Therefore, this step is not applicable for this ACP.

<u>Step 2: ACP Stormwater Pollutant Control Calculations</u>

The Earned Stormwater Pollutant Control Volume will be calculated per ***<u>Equation 2-1</u>***.

$$V_E = L\,(\Delta V + V_2B_2 - V_1B_1)$$

<u>Where:</u>

V_E: Earned Stormwater Pollutant Control Volume (ft^3)
L: Land Use Factor
ΔV: Change in Design Capture Volume ($V_1 - V_2$)
V_1: Impacted Condition Design Capture Volume for ACP
V_2: Mitigated Condition Design Capture Volume for ACP
B_1: Impacted Condition BMP Efficacy Factor
B_2: Mitigated Condition BMP Efficacy Factor

<u>Task 2-1: Determine Design Capture Volume (DCV) Tributary to the ACP</u> (V_1, V_2, ΔV)

In order to perform water quality equivalency calculations, the ACP applicant must determine the impacted condition DCV (V_1), the mitigated condition DCV (V_2), and the change in DCV (ΔV) as presented below.

<u>Calculate Impacted Condition DCV</u> (V_1)

For land preservation ACPs, the impacted condition DCV represents the DCV associated with the future anticipated built-out condition of the land that will be prevented through preservation. The applicant delineates an ACP tributary area of 0.11 acres, identifies an 85th percentile rainfall depth of 0.77", and determines that the future impacted condition would not provide any retention or biofiltration. Per methods presented in Appendix B.1 of the BMPDM, the area weighted average runoff coefficient is calculated as 0.80 based on its future land use. Therefore, the impacted condition DCV (V1) for this project is calculated as:

(Continued on next page)

V_1 = Runoff Coefficient x Rainfall Depth x Tributary Area

V_1 = 0.80 x 0.77 in x 0.11 ac x (43,560 ft^2/1 ac) x (1 foot/12 in) = 246 cubic feet

Calculate Mitigated Condition DCV (V_2)

Forland preservation ACPs, the mitigated condition DCV represents the DCV associated with the existing site conditions that will be preserved in perpetuity. The proposed ACP will preserve site in its existing, stabilized condition consisting of native vegetation (C=0.10). Therefore, the mitigated condition DCV (V_2) for this project is calculated as:

V_2 = Runoff Coefficient x Rainfall Depth x Tributary Area

V_2 = 0.10 x 0.77 in x 0.11 ac x (43,560 ft^2 /1 ac) x (1 foot/12 in) = 31 cubic feet

Calculate Change in DCV (ΔV)

The impacted condition DCV is greater than the mitigated condition DCV; therefore, the change in DCV is calculated as:

$\Delta V = V_1 - V_2$

ΔV = 246 cubic feet – 31 cubic feet = 215 cubic feet

Task 2-2: Calculate Land Use Factor (L)

In order to calculate an appropriate land use factor, the ACP applicant must identify the WQE pollutants of concern, calculate relative pollutant concentrations for the ACP tributary, and calculate relative pollutant concentrations for the reference tributary.

Task 2-2A: WQE Pollutants of Concern

*The ACP is identified to be within the San Diego River WMA and hydrologic unit, so the WQE pollutants of concern are TP, TN, and FC per **Table 2-1** of this guidance.*

Task 2-2B: ACP Tributary Relative Pollutant Concentrations

The ACP tributary is characterized by the land uses identified in the example description above.

Task 2-2C: Reference Tributary Relative Pollutant Concentrations

*The reference tributary for an Independent ACP within the San Diego River WMA is characterized by the land use composition values presented in **Table 2-3** of this guidance.*

Task 2-2D: Determine Land Use Factors

*The appropriate land use compositions and associated runoff factors are then tabulated into the input fields of **Worksheet A.5** and associated land use factors are calculated for each WQE pollutant of concern through utilization of **Equation 2-2**. This step may also be performed through utilization of the automated land use factor calculation tool available on www.projectcleanwater.org, as is demonstrated in this example. The lowest resulting land use factor is selected for incorporation into the stormwater pollutant reduction calculations. Therefore, the land use factor for this ACP is based on Total Phosphorus (TP) which equals 0.62 as depicted in the figure below.*

(Continued on next page)

Land Use Designation	ACP Tributary Characteristics		Reference Tributary Characteristics [2]		Relative Pollutant Concentrations by Land Use [3]						
	Area (Acres)	Runoff Factor [1]	Area (Acres)	Runoff Factor [1]	TSS	TP	TN	Tcu	TPb	TZn	FC
Agriculture	0.00	0.10	2,816.00	0.10	0.45	1.00	1.00	1.00	1.00	0.59	1.00
Commercial	0.11	0.80	4,043.00	0.80	0.13	0.16	0.16	0.56	0.48	1.00	0.87
Education	0.00	0.50	5,159.00	0.50	0.13	0.20	0.11	0.14	0.25	0.39	0.13
Industrial	0.00	0.90	3,660.00	0.90	0.13	0.19	0.15	0.54	0.68	0.89	0.49
Multi Family Residential	0.00	0.60	4,979.00	0.60	0.10	0.13	0.13	0.14	0.15	0.29	0.27
Orchard	0.00	0.10	1,060.00	0.10	0.18	0.17	0.67	1.00	1.00	0.59	0.11
Rural Residential	0.00	0.30	18,073.00	0.30	1.00	0.51	0.14	0.10	0.71	0.13	0.19
Single Family Residential	0.00	0.40	24,131.00	0.40	0.13	0.20	0.15	0.27	0.43	0.35	0.63
Transportation	0.00	0.90	13,822.00	0.90	0.11	0.26	0.12	0.53	0.31	0.62	0.12
Vacant / Open Space	0.00	0.10	0.00	0.10	0.16	0.10	0.10	0.12	0.10	0.10	0.10
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.11	-	77,743	-	-	-	-	-	-	-	-
	Relative Pollutant Concentration for ACP Tributary [4]				0.13	0.16	0.16	0.56	0.48	1.00	0.87
	Relative Pollutant Concentration for Reference Tributary [4]				0.24	0.26	0.14	0.36	0.43	0.50	0.36
	Watershed Management Area				San Diego River						
	Hydrologic Unit				San Diego (907.00)						
	Land Use Factor [5]				-	0.62	**1.12**	-	-	-	**2.41**

***Task 2-3: Calculate BMP Efficacy Factors** (B_1, B_2)*

BMP efficacy factors are a function of an ACP's pollutant removal efficiency (Task 2-3a) and provided capture values (Task 2-3b). In order to perform water quality equivalency calculations, the applicant must determine the impacted condition BMP efficacy factor (B_1), and the mitigated condition BMP efficacy factor (B_2) for the ACP.

Impacted Condition BMP Efficacy Factor (B_1)

The impacted condition of a land preservation NSMP corresponds with the future anticipated built-out condition of the land that will be prevented through preservation. As outlined in the example statement, it is anticipated that the built out condition of this parcel would not include any BMP elements; therefore, the impacted condition BMP efficacy factor (B_1) is zero.

$B_1=0.00$

Mitigated Condition BMP Efficacy Factor (B_2)

Land preservation is a NSMP implemented to preserve predevelopment watershed functions in lieu of providing direct management of stormwater pollutant control and hydromodification flow control. NSMPs may include structural/engineered elements, but these elements do not expressly provide stormwater pollutant control benefits. The mitigated condition BMP efficacy factor (B_2) is equal to the impacted condition BMP efficacy factor (0.00).

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***Task 2-4: Calculate Earned Stormwater Pollutant Control Volume* (V_E)**

The Earned Stormwater Pollutant Control Volume for an ACP is calculated by populating ***Equation 2-1*** *with the appropriate volumes, land use factors, and BMP efficacy factors determined per the guidelines set forth in* ***Section 2.3****. The Earned Stormwater Pollutant Control Volume for this ACP is calculated as:*

$V_E = L\ (\Delta V + V_2B_2 - V_1B_1)$

$V_E = 0.62 \times [215 + (31 \times 0.00) - (246 \times 0.00)]$

$V_E = 133$ cubic feet

Step 3: Determination of Stormwater Pollutant Control Credits

An overall water quality benefit for stormwater pollutant control can be demonstrated if the Earned Stormwater Pollutant Control Volume calculated in Step 2 is greater than or equal to the Deficit of Stormwater Pollutant Control Volume calculated in Step 1. Because this is an Independent ACP, a volume has not yet been determined for Step 1. Therefore, Stormwater Pollutant Control Volume Credit of 133 cubic feet may be banked for potential future purchase by a PDP applicant with a Deficit of Stormwater Pollutant Control Volume of 133 cubic feet or less. Note that trading/selling of such credits is contingent on the approval of a credit system.

Example 4.5 - Part II: WQE for Hydromodification Flow Control

Hydromodification flow control benefits may be quantified when a land preservation ACP prevents existing undeveloped land from being developed to non-PDP standards. As stated in the example description above, this land preservation NSMP prevents the development of a 0.11 acre non-PDP commercial development. If we assume the same project described for the example description, the Independent ACP of 0.11 acres that is zoned for 100% Commercial could receive a maximum credit of 0.11 acres assuming all directly connected impervious area (DCIA).

Example 4.5 - Part III: WQE for Stormwater Pollutant Control and Hydromodification Flow Control

This land preservation NSMP example shows how the same project achieves both a reduction in future runoff of the water quality design control volume and a reduction in future directly connected impervious surface, which meets both water quality and HMP credit generating criteria.

4.6 Example 4-6: Stream Rehabilitation NSMP Example

Problem Statement

A 1,000 acre watershed discharges to the Pacific Ocean. In the existing condition, there are 200 acres of DCIA in the watershed. Given the hypothetical watershed data indicated below, this example will show the extent of credits that can be generated for the watershed by implementing stream rehabilitation where necessary.

The following is the example problem data:

- *Total watershed area: 1,000 acres*
- *Existing DCIA: 200 acres*
- *Mean annual precipitation: 10 inches*
- *Additional DCIA from new development through year 2050: 20 acres*
- *Estimated redevelopment in the watershed to 2050: 5% = 5% * 200 acres = 10 acres*
- *Number of GCUs: 3*
- *GCU_1 characteristics:*
  - *Drainage area: 300 acres; Existing DCIA: 40 acres; Additional DCIA: 2 acre*
  - *Channel form: CEM Type I*
  - *GCU length: 1,500 ft*
  - *Median Grain Size(d_{50}): 20 mm*
  - *Channel Physical Characteristics - Width: 5 ft; Slope: 3%*
  - *Erosion potential (Ep): 1.02*
- *GCU_2 characteristics:*
  - *Drainage area: 600 acres; Existing DCIA: 100 acres; Additional DCIA: 6 acres*
  - *Channel form: CEM Type I*
  - *GCU length: 3,500 ft*
  - *Median grain size(d_{50}): 10 mm*
  - *Channel physical characteristics -Width: 10 ft; Slope: 2%*
  - *Erosion potential (Ep): 1.03*
- *GCU_3 characteristics:*
  - *Drainage area: 1,000 acres; Existing DCIA: 200 acres; Additional DCIA: 20 acres*
  - *Channel form: CEM Type IV*
  - *Vertical susceptibility: Low; Lateral susceptibility: High*
  - *GCU length: 2,000 ft*
  - *Median grain size(d_{50}): 20 mm*
  - *Channel physical characteristics: Width: 15 ft; Slope: 1%*

Part I: WQE for Stormwater Pollutant Control

Stream Rehabilitation may provide quantifiable stormwater pollutant control benefits through the reduction of impervious channel surfaces. This stream rehabilitation ACP does not propose the removal of any existing impervious channel surfaces; therefore; no stormwater pollutant control credits will be generated by this project.

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Part II: WQE for Hydromodification Flow Control

*The example calculation will follow the steps presented in **Section 3.6** and **Section C.2** of this WQE document.*

Step 1: Identify the stream rehabilitation hydromodification equivalency scenario

*Based on the problem data provided, it is scenario 3, i.e. watershed-based stream rehabilitation for sensitive portions of the receiving water in a watershed for full planned development (**Section 3.6.1**).*

Step 2: Channel assessment process and stream rehabilitation approach

*In order to identify the sensitive portions of the receiving waters in the watershed that require stream rehabilitation the following steps from **Section 3.6.2** and **Section C.2** are implemented:*

Step 2.1: Identify domain of analysis and divide into GCUs

*Based on the problem data provided, watershed has 3 GCUs. Applicant shall use guidance in **Section C.2.1** to identify the domain of analysis and divide the domain of analysis into GCUs when this information is not provided.*

Step 2.2: Field assessment (Part 1) assess whether channel is stable or unstable

*For each GCU delineated in Step 2.1, the applicant shall perform field assessment using guidance in **Section C.2.2** to assess if the GCU has a stable form or unstable form. For this example based on data provided and **Section C.2.2**:*

- *GCU_1 channel form = CEM Type I = Stable form*
- *GCU_2 channel form = CEM Type I = Stable form*
- *GCU_3 channel form = CEM Type IV = Unstable form*

Step 2.3: Evaluation of stable form GCUs

*GCUs that are identified to have stable form in Step 2.2 shall be evaluated using guidance in **Section C.2.3** and **Equation 3-1** to determine if the GCU can support geomorphic impact for the build out condition or if they will require hydromodification mitigation measures. Based on results from Step 2.2, GCU_1 and GCU_2 have stable forms. The following provides the estimates for each GCU:*

- *GCU_1*
    - *Specific stream power*
        - *Geomorphic stability = 120 watt/m^2 for d_{50} = 20 mm (**Figure C-2**)*
        - *Geomorphic impact*
            - *Build out imperviousness = 42/300 = 14%*
            - *Adjustment factor = 1.14 (**Figure C-3**)*
            - *$Q_{10cfs} = 1.14 * 18.2 * ((300/640)^{0.87})*(10^{0.77}) = 63$ cfs (**Equation C-4**)*
            - *$Q_{10cms} = 0.0283 * 63 = 1.8$ cms*
            - *Specific Stream Power = [9810 * 1.8 * 0.03]/5 = 106 watt/m^2 (**Equation C-1**)*
        - *Geomorphic stability is greater than geomorphic impact so no stream rehabilitation measures are necessary.*

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- Erosion potential
  - *Threshold < 1.20 since d_{50} > 16 mm*
  - *Ep = 1.02 (given for this example)*
  - *Since Ep is less than the threshold no stream rehabilitation measures are necessary.*
- GCU_2
  - *Specific stream power*
    - *Geomorphic stability = 95 watt/m^2 for d_{50} = 10 mm (**Figure C-2**)*
    - *Geomorphic impact*
      - *Build out imperviousness = 106/600 = 18%*
      - *Adjustment factor = 1.17 (**Figure C-3**)*
      - $Q_{10cfs} = 1.17 * 18.2 * ((600/640)^{0.87})*(10^{0.77}) = 119$ *cfs (**Equation C-4**)*
      - $Q_{10cms} = 0.0283 * 119 = 3.4$ *cms*
      - *Specific Stream Power = [9810 * 3.4 * 0.02]/10 = 67 watt/m^2 (**Equation C-1**)*
    - *Geomorphic stability is greater than geomorphic impact so no stream rehabilitation measures are necessary.*
  - *Erosion potential*
    - *Threshold < 1.05 since d_{50} < 16 mm*
    - *Ep = 1.03 (given for this example)*
    - *Since Ep is less than the threshold no stream rehabilitation measures are necessary.*

Based on the results presented above, GCU_1 and GCU_2 can support full planned development without requiring hydromodification mitigation measures.

Step 2.4: Desk and field assessment

*Desk and field assessment shall be performed using guidance from **Section C.2.4** for GCUs that are identified to have unstable form in Step 2.2. Based on results from Step 2.2, GCU_3 has an unstable form in this example. The following are the results from the desk and field assessment for GCU_3 (provided in this example):*

- *Vertical susceptibility: Low*
- *Lateral susceptibility: High*

Step 2.5: Develop and implement hydromodification mitigation measures for sensitive segments

*Based on results from Steps 2.3 and 2.4, GCU_3 requires hydromodification mitigation measures to support the geomorphic impact from the full build out condition since it has an unstable form. From Step 2.4, GCU_3 has a low vertical susceptibility and a high lateral susceptibility, so the rehabilitation involves widening the bankfull channel and/or creating a wider two stage channel with a floodplain bench above the bankfull channel. Applicant shall develop a rehabilitation design following guidelines and recommendations provided in **Section C.2.5**.*

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Step 3: Determine stream rehabilitation hydromodification flow control equivalency currency

*As presented in Step 2, GCU_1 and GCU_2 can support full planned development, while GCU_3 must be rehabilitated to support full planned development in the watershed. Once GCU_3 is rehabilitated, it is anticipated that the receiving waters in the watershed can sufficiently convey the geomorphically significant flows without experiencing hydromodification. Benefit derived from the rehabilitation project (credit) is distributed to the DCIAs in the watershed that are required to implement hydromodification flow control BMPs to meet the requirements established by the MS4 Permit (**Section 3.6.3**). The credits generated by implementing the stream rehabilitation in this example watershed are as follows: New development to 2050 + Redevelopment to 2050 = 20 acres + 10 acres = **30 acres of DCIA**.*

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Appendix A: Water Quality Equivalency Worksheets

The attached WQE worksheets are provided for applicants who elect to manually calculate stormwater pollutant control benefits associated with an ACP; however, applicants are encouraged to utilize the automated versions of these spreadsheets that are available for download at www.projectcleanwater.org.

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Worksheet A.1: Retention BMP Efficacy Factor Determination for Water Quality Equivalency (Version 1.0)

Category	#	Description	Value	Units	Notes
BMP Inputs	1	Design Capture Volume Tributary to BMP		cubic-feet	User Input from BMPDM
	2	Provided BMP Surface Area		sq-ft	User Input
	3	Provided Surface Ponding Depth		inches	User Input
	4	Provided Soil Media Thickness		inches	User Input, 18 inches minimum
	5	Provided Gravel Storage Thickness		inches	User Input, use a value of zero if gravel does not cover entire bottom
	6	Native Soil Infiltration Rate		in/hr	User Input from BMPDM
Retention Calculations	7	Volume Infiltrated Over 6 Hour Storm		cubic-feet	Minimum of Line 1 or [Line 2 x (Line 6/12) x 6]
	8	Soil Media Pore Space	0.30	-	Default = 0.30 for Retention-Only BMPs
	9	Gravel Pore Space	0.40	-	Default = 0.40
	10	Effective Depth of Retention Storage		inches	[Line 3 + (Line 4 x Line 8) + (Line 5 x Line 9)]
	11	Drawdown Time for Surface Ponding		hours	[Line 3 / Line 6]. Must be less than 24 hours.
	12	Drawdown Time for Entire Bioretention Basin		hours	[Line 10 / Line 6]. Must be between 6 and 120 hours.
	13	Volume Retained by BMP		cubic-feet	[Line 2 x (Line 10/12) + Line 7]
	14	Fraction of DCV Retained		ratio	[Line 13/Line 1]. Maximum of 3.00
	15	Provided Capture for Specified Retention BMP		ratio	Look up value from Retention Provided Capture Curves, Maximum of 1.00.
	16	**Retention BMP Efficacy Factor for Use in WQE Formula**		ratio	[Line 15 x 1.00]

Notes:

1. Applicants must provide user input for yellow shaded cells and calculate blank cells as indicated.
2. Refer to **Section 2.3.1.3** of the guidance document for additional discussion of BMP Efficacy Factors.

Worksheet A.2: Biofiltration BMP Efficacy Factor Determination for Water Quality Equivalency (Version 1.0)

Category	#	Description	Value	Units	Notes
BMP Inputs	0	Effective Tributary Area		sq-ft	User Input (Tributary Runoff Coefficient x Tributary Area)
	1	Design Capture Volume Tributary to BMP		cubic-feet	User Input from BMPDM
	2	Provided BMP Surface Area		sq-ft	User Input, must be ≥ 3% of Effective Tributary Area.
	3	Provided Surface Ponding Depth		inches	User Input
	4	Provided Soil Media Thickness		inches	User Input, 18 inches minimum
	5	Provided Gravel Storage Thickness		inches	User Input, use a value of zero if gravel does not cover entire bottom.
	6	Hydromodification Orifice Diameter of Underdrain		inches	User Input, Select n/a if no hydromodification flow control is provided
Biofiltration Calculations	7	Max Hydromod Flow Rate through Underdrain		CFS	If flow controls are provided, calculate per orifice equation below
	8	Max Soil Filtration Rate Allowed by Underdrain Orifice		in/hr	If flow controls are provided, calculate as [(Line 7 x 12 x 3600)/Line 2]
	9	Soil Media Filtration Rate	5.00	in/hr	Default = 5.00
	10	Soil Media Filtration Rate to be used for Sizing		in/hr	Minimum of Line 8 or Line 9
	11	Depth Biofiltered Over 6 Hour Storm		inches	[Line 10 x 6 Hours]
	12	Soil Media Pore Space	0.30	-	Default = 0.30 for Biofiltration-Only BMPs
	13	Gravel Pore Space	0.40	-	Default = 0.40
	14	Effective Depth of Biofiltration Storage		inches	[Line 3 + (Line 4 x Line 12) + (Line 5 x Line 13)]
	15	Drawdown Time for Surface Ponding		hours	[Line 3 / Line 10]
	16	Drawdown Time for Entire Biofiltration Basin		hours	[Line 14 / Line 10]
	17	Total Depth Biofiltered		inches	[Line 11 + Line 14]
	18	Option 1 - Biofilter 1.50 DCV: Target Volume		cubic-feet	[1.50 x Line 1]
	19	Option 1 - Provided Biofiltration Volume		cubic-feet	[Minimum of Line 18 or [(Line 17/12) x Line 2]]
	20	Option 2 - Store 0.75 DCV: Target Volume		cubic-feet	[0.75 x Line 1]
	21	Option 2 - Provided Storage Volume		cubic-feet	[Minimum of Line 20 or [(Line 14/12) x Line 2]]
	22	Provided Capture for Biofiltration BMP		ratio	[Maximum of (1.50 x Line 19/Line 18) or (1.50 x Line 21/Line 20)]
	23	**Biofiltration BMP Efficacy Factor for Use in WQE Formula**		ratio	[Line 22 x 0.666]

Notes:

1. Applicants must provide user input for yellow shaded cells and calculate blank cells as indicated.
2. Refer to **Section 2.3.1.3** of the guidance document for additional discussion of BMP Efficacy Factors.
3. Orifice Equation: $Q = CA\sqrt{2gh}$

   Where Q: Flow Rate (cfs), C: Discharge Coefficient (0.60), A: Area of Orifice Opening (ft^2), g: acceleration of gravity (ft/s^2), and h: head difference across orifice (ft)

Worksheet A.3: Partial Retention BMP Efficacy Factor Determination for Water Quality Equivalency (Version 1.0)

Category	#	Description	Value	Units	Notes
BMP Inputs	0	Effective Tributary Area		sq-ft	User Input (Tributary Runoff Coefficient x Tributary Area)
	1	Design Capture Volume Tributary to BMP		cubic-feet	User Input from BMPDM
	2	Provided BMP Surface Area		sq-ft	User Input, must be ≥ 3% of Effective Tributary Area.
	3	Provided Surface Ponding Depth		inches	User Input
	4	Provided Soil Media Thickness		inches	User Input, 18 inches minimum
	5	Provided Depth of Gravel Above Underdrain Invert		inches	User Input, use a value of zero if gravel does not cover entire bottom.
	6	Hydromodification Orifice Diameter of Underdrain		inches	User Input, select n/a if no hydromodification flow control is provided
	7	Provided Depth of Gravel Below the Underdrain		inches	User Input
	8	Native Soil Infiltration Rate		in/hr	User Input from BMPDM
Retention Calculations	9	Soil Media Pore Space Available for Retention	0.10	-	Default = 0.10 for Retention Portion of Partial Retention BMP
	10	Gravel Pore Space Available for Retention	0.40	-	Default = 0.40
	11	Effective Retention Depth		inches	(Line 4 x Line 9)+ (Line 7 x Line 10)
	12	Calculated Drawdown for Gravel Below Underdrain		hours	Maximum of 6 or [(Line 7 x Line 10) / Line 8]
	13	Volume Retained by BMP		cubic-feet	[(Line 11/12) x Line 2}
	14	Fraction of DCV Retained		ratio	[Line 13/Line 1]
	15	Provided Capture for Specified Retention BMP		ratio	Look up value from Retention Provided Capture Curves, Maximum of 1.00.
	16	BMP Efficacy Factor for Retention Element		ratio	[Line 15 x 1.00]
	17	Equivalent Fraction of DCV Retained with 36-hr Drawdown		ratio	Look up value from Retention Provided Capture Curves, Maximum of 1.00.
	18	Design Capture Volume Remaining for Biofiltration		cubic-feet	[Line 1 x (1.00 - Line 17)]
Biofiltration Calculations	19	Max Hydromod Flow Rate through Underdrain		CFS	If flow controls are provided, calculate per orifice equation below
	20	Max Soil Filtration Rate Allowed by Underdrain Orifice		in/hr	If flow controls are provided, calculate as [(Line 19 x 12 x 3600)/Line 2]
	21	Soil Media Filtration Rate per Specifications	5.00	in/hr	Default = 5.00
	22	Soil Media Filtration Rate to be used for Sizing		in/hr	Minimum of Line 20 or Line 21
	23	Depth Biofiltered Over 6 Hour Storm		inches	[Line 22 x 6]
	24	Soil Media Pore Space Available for Biofiltration	0.20	-	Default = 0.20 for Biofiltration Portion of Partial Retention BMP
	25	Effective Depth of Biofiltration Storage		inches	[Line 3 + (Line 4 x Line 24) + (Line 5 x Line 10)]
	26	Drawdown Time for Surface Ponding		hours	Minimum of [Line 3/5.00] or [Line 3/(Line 8 + Line 22)]
	27	Drawdown Time for Effective Biofiltration Depth		hours	Minimum of [Line 25/5.00] or [Line 25/(Line 8 + Line 22)]
	28	Total Depth Biofiltered		inches	[Line 23 + Line 25]
	29	Option 1 - Biofilter 1.50 DCV: Target Volume		cubic-feet	[1.50 x Line 18]
	30	Option 1 - Provided Biofiltration Volume		cubic-feet	[Minimum of Line 29 or [(Line 28/12) x Line 2]]
	31	Option 2 - Store 0.75 DCV: Target Volume		cubic-feet	[0.75 x Line 18]
	32	Option 2 - Provided Storage Volume		cubic-feet	[Minimum of Line 31 or [(Line 25/12) x Line 2]]
	33	Provided Capture for Specified Biofiltration BMP		ratio	[Maximum of (1.50 x Line 30/Line 29) or (1.50 x Line 32/Line 31)]
	34	BMP Efficacy Factor for Biofiltration Element		ratio	[(1.00 - Line 16) x Line 33 x 0.666]
BMP Factor	35	**Partial Retention BMP Efficacy Factor for Use in WQE Formula**		ratio	[Line 16 + Line 34]

Notes:

1. Applicants must provide user input for yellow shaded cells and calculate blank cells as indicated.
2. Refer to **Section 2.3.1.3** of the guidance document for additional discussion of BMP Efficacy Factors.
3. Orifice Equation: $Q = CA\sqrt{2gh}$

   Where Q: Flow Rate (cfs), C: Discharge Coefficient (0.60), A: Area of Orifice Opening (ft^2), g: acceleration of gravity (ft/s2), and h: head difference across orifice (ft)

Worksheet A.4: Treatment Train BMP Efficacy Factor Determination for WQE (Version 1.0)

Pollutant	BMP_1		BMP_2		BMP_3		**BMP Efficacy Factor B**
	Pollutant Removal Efficiency E_1	Provided Capture Value C_1	Pollutant Removal Efficiency E_2	Provided Capture Value C_2	Pollutant Removal Efficiency E_3	Provided Capture Value C_3	
TSS							
FC							
TN							
TP							
Tcu							
TZn							
TPb							

Notes:

1. Applicants must provide user input for yellow shaded cells and calculate blank cells as indicated.
2. This worksheet is for use in the determination of BMP Efficacy Factors for a single BMP that incorporates multiple treatment elements. All elements identified in this worksheet must accept drainage from the same tributary area with BMP_1 representing the most upstream treatment element, and BMP_3 representing the most downstream treatment element.
3. Provide user input for pollutant removal efficiencies (E) for each of the proposed treatment elements as a decimal percentage. Retention and biofiltration elements provide pollutant removal efficiencies of 1.00 and 0.666 across all pollutants respectively. Flow-thru pollutant removal efficiencies have not been established by this document; if established, such values will vary for each pollutant considered. Refer to **Section 2.3.1.3.1** for additional text on pollutant removal efficiencies.
4. Provide user input for provided capture values (C) for each of the proposed treatment elements as a decimal percentage. Provided Capture values for retention, biofiltration, partial retention, and flow-thru BMPs are determined per **Sections 2.3.1.3.2.1** through **2.3.1.3.2.4** respectively. Treatment trains BMPs implementing a combination of volume-based and flow-based BMPs and/or implementing treatment elements downstream of a retention element require additional considerations to determine appropriate provided Capture values as discussed in **Section 2.3.1.3.2.5.**
5. Calculate the BMP Efficacy Factor for the proposed treatment train BMP per **Equation 2-5**. (Note that the sumation of ExCx products may never be greater than 1.00).

Equation 2-5: BMP Efficacy Factor for Treatment Train BMPs

$$B = E_1C_1 + [(1-E_1C_1) \times E_2C_2] + [(1-E_1C_1-E_2C_2) \times E_3C_3]$$

Where:
B: BMP Efficacy Factor
$E_{1,2,3}$: Pollutant Removal Efficiency (1 being most upstream and 3 being most downstream element)
$C_{1,2,3}$: Provided Capture (1 being most upstream and 3 being most downstream element)

Worksheet A.5: Land Use Factor Determination (Version 1.0)

Land Use Designation	ACP Tributary Characteristics		Reference Tributary Characteristics [2]		Relative Pollutant Concentrations by Land Use [3]						
	Area (Acres)	Runoff Factor [1]	Area (Acres)	Runoff Factor [1]	TSS	TP	TN	TCu	TPb	TZn	FC
Agriculture					0.45	1.00	1.00	1.00	1.00	0.59	1.00
Commercial					0.13	0.16	0.16	0.56	0.48	1.00	0.87
Education					0.13	0.20	0.11	0.14	0.25	0.39	0.13
Industrial					0.13	0.19	0.15	0.54	0.68	0.89	0.49
Multi Family Residential					0.10	0.13	0.13	0.14	0.15	0.29	0.27
Orchard					0.18	0.17	0.67	1.00	1.00	0.59	0.11
Rural Residential					1.00	0.51	0.14	0.10	0.71	0.13	0.19
Single Family Residential					0.13	0.20	0.15	0.27	0.43	0.35	0.63
Transportation					0.11	0.26	0.12	0.53	0.31	0.62	0.12
Vacant / Open Space					0.16	0.10	0.10	0.12	0.10	0.10	0.10
Water					0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		-		-	-	-	-	-	-	-	-
	Relative Pollutant Concentration for ACP Tributary [4]										
	Relative Pollutant Concentration for Reference Tributary [4]										
	Watershed Management Area										
	Hydrologic Unit										
	Land Use Factor [5]										

Notes:

* Applicants must provide user input for yellow shaded cells and calculate blank cells as indicated.

1. Revisions to default runoff factors must be supported to the satisfaction of the applicable Copermittee.

2. Applicant-Implemented ACPs must identify reference tributary characteristics that are representative of their specific PDP. Independent ACPs must reference **Table 2-3** for appropriate area and runoff factor information applicable to their watershed management area.

3. Relative Pollutant Concentrations by Land Use have been identified through examination of available EMC data. Additional information on how these relative concentrations were developed is provided in **Appendix B**.

4. Relative Pollutant Concentrations for ACP and Reference Tributaries are calculated for each WQE Pollutant of Concern per **Equation 2-2**.

5. Calculate the Land Use Factor for each priority pollutant by dividing the Relative Pollutant Concentration for the ACP Tributary by the Relative Pollutant Concentration for the Reference Tributary. Land Use Factors may never be lower than 0.10 and may never exceed 10.0.

Example: An ACP Tributary with 5.25 acres of Commercial, 1.63 Acres of Education, and 2.65 acres of Transportation land uses produces a relative pollutant concentration 0.12 for Total Suspended Solids (assumes default runoff factors are applied).

Equation 2-2:

$$P_1 = \frac{\sum P_{1a}A_aC_a + P_{1b}A_bC_b + \dots\dots P_{1k}A_kC_k}{\sum A_aC_a + A_bC_b + \dots\dots A_kC_k}$$

Equation 2-2 Applied to Example:

$$P_{TSS} = \frac{(0.13x5.25x0.80) + (0.13x1.63x0.50) + (0.11x2.65x0.90)}{(5.25x0.80) + (1.63x0.50) + (2.65x0.90)} = 0.12$$

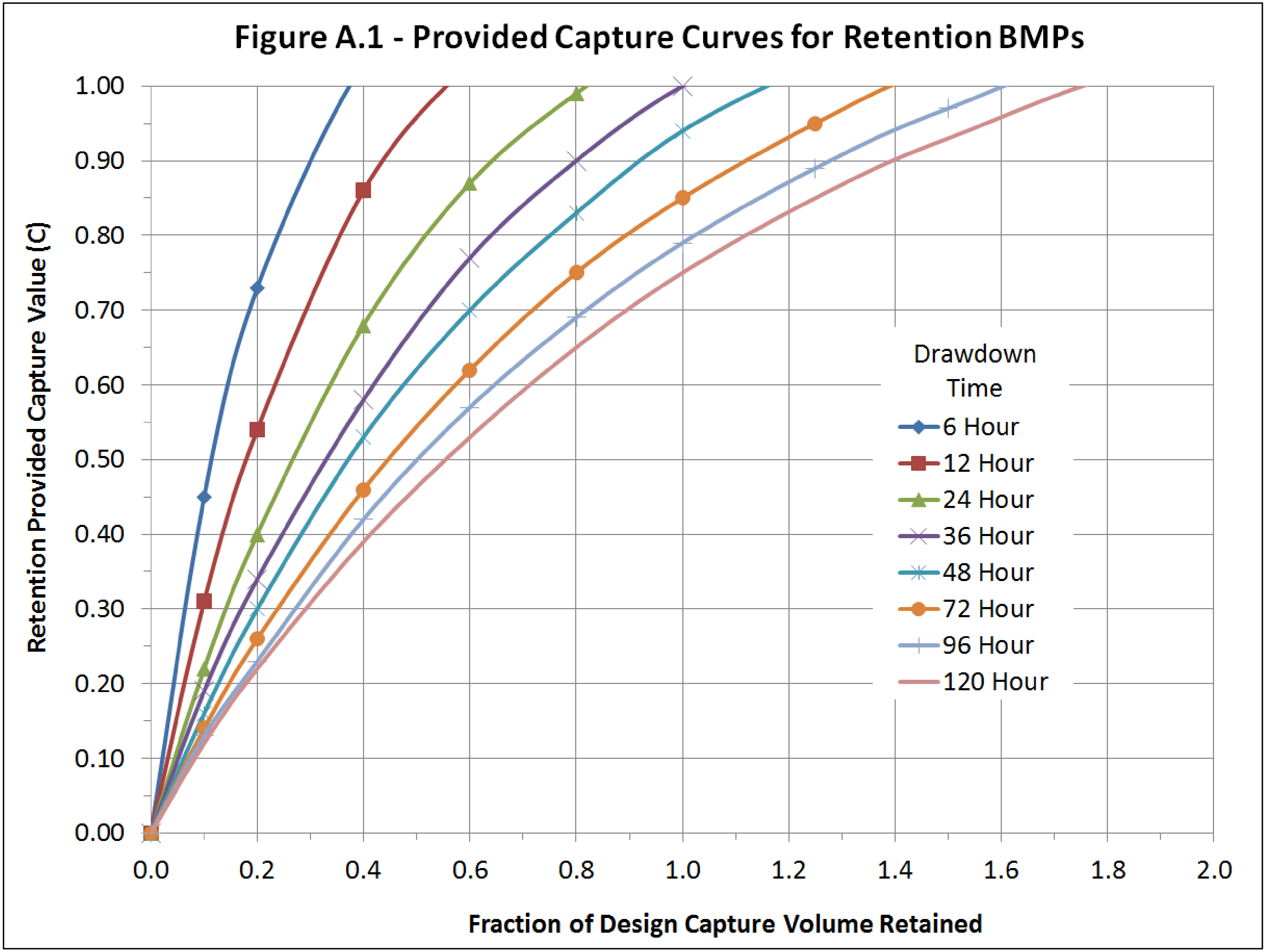

Figure A.1 - Provided Capture Curves for Retention BMPs
Retention Provided Capture Value (C)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
Fraction of Design Capture Volume Retained
Drawdown Time
6 Hour
12 Hour
24 Hour
36 Hour
48 Hour
72 Hour
96 Hour
120 Hour

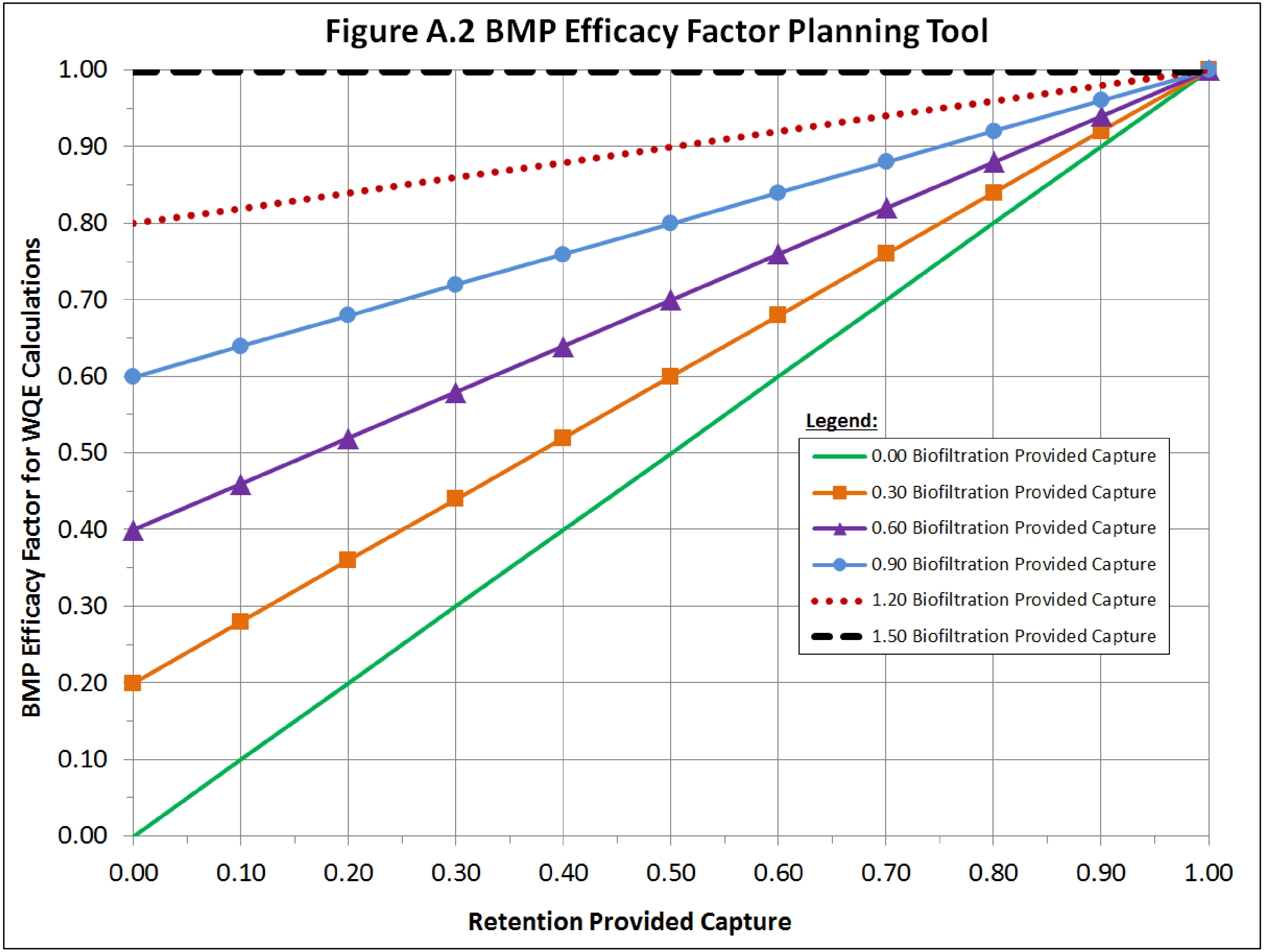
Figure A.2 BMP Efficacy Factor Planning Tool
BMP Efficacy Factor for WQE Calculations
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
Retention Provided Capture
Legend:
0.00 Biofiltration Provided Capture
0.30 Biofiltration Provided Capture
0.60 Biofiltration Provided Capture
0.90 Biofiltration Provided Capture
1.20 Biofiltration Provided Capture
1.50 Biofiltration Provided Capture

Appendix B: WQE Stormwater Pollutant Control Reference Information

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B.1. Land Use Factor Supporting Material

Land use factors account for variations in relative pollutant concentrations supplied to ACPs and PDPs based on their tributary land uses. This section outlines the methodologies used to establish the WQE pollutants of concern for each WMA and summarizes the data used to establish appropriate land use specific pollutant concentrations.

B.1.1. Determination of WQE Pollutants of Concern

This guidance document has identified several WQE pollutants of concern for each WMA that must be accounted for by water quality equivalency stormwater pollutant control calculations in order to best contribute towards identified WMA goals. WQE pollutants of concern have been established through examination of published 303(d) listings, pollutant prioritizations within available WQIPs, and land use vs pollutant discharge concentration relationships identified in available EMC data.

The entire 303(d) list was originally presented to be used for the purpose of evaluating which pollutants to use for establishing relative pollutant loads between a PDP and an ACP. During the TAC meeting held on November 5, 2014, it was noted by TAC members that it would be appropriate to consider a list of constituents that was reduced in size from the total 303(d) based on specific WMA conditions as identified in the WQIPs. A primary factor for this determination was due to the fact that available EMC data used to establish stormwater pollutant concentrations with respect to land use type does not include an exhaustive list of all known pollutants.

The draft WQIPs posted on the San Diego Regional Water Quality Control Board website were reviewed for the following WMAs: Los Penasquitos (April, 2014), San Dieguito River (April, 2014), Mission Bay (April, 2014), Carlsbad (June, 2014), Tijuana River (June, 2014), San Diego River (April, 2014), San Luis Rey (April, 2014), and San Diego Bay (June, 2014). San Juan and Santa Margarita watershed management areas did not have WQIPs available for review

Review of the WQIPs indicated that WQIP priority pollutants generally correspond with pollutants on the 2010 303(d) list. However, in some instances WQIP priority pollutants include additional pollutants that are not in the 2010 303(d) list and in other instances WQIP priority pollutants do not include all 2010 303(d) listed pollutants. The highest priority is generally one pollutant in a WMA that, if removed with BMPs, would result in the removal of most other pollutants and achieve water quality objectives for that receiving water.

In order to translate this information into WQE pollutants of concern, the WQE team explored each of the alternatives discussed below and ultimately selected the combined pollutants approach to establish WQE pollutants of concern for each WMA.

<u>303(d) Pollutants</u>

The 303(d) pollutants for each waterbody could be used as originally considered. Many of the 303(d) pollutants do not have EMC data to use to estimate the loads from different land uses. A large number of surrogates, for which EMC data is available, would need to be established in order to approximate a land use factor for those pollutants. While this is the most comprehensive list of pollutants, it requires a significant number of broad assumptions to be made about pollutants, and may ultimately hinder an offsite alternative compliance program from achieving specific water quality goals.

Priority Pollutants

The priority pollutants from the WQIPs could be used. These pollutants include most or all of 303(d) pollutants. As noted above, in some WMAs, pollutants have been added and/or withdrawn from the 303(d) list. A large number of surrogates, for which EMC data is available, would need to be established in order to approximate a land use factor for those pollutants. While this is the most comprehensive list of pollutants, it requires a significant number of broad assumptions to be made about pollutants, and may ultimately hinder an alternative compliance program from achieving specific water quality goals.

Highest Priority Pollutants

The methodology that the draft WQIPs are using to establish the highest priorities typically result in one to four highest priority pollutants for each WMA. Several WMAs only list a single pollutant. Using such a list for WQIPs may allow for specific WMA goals to be addressed most efficiently.

Combined Pollutants

The combined pollutants method supplements the highest priority pollutants from the WQIPs with additional pollutants from the more comprehensive priority pollutants list. It is anticipated that this method will produce the most effective results as it allows for specific WMA goals to be addressed efficiently but does not overlook 303(d) listed pollutants that may have a significant negative impact to receiving water quality. The combined pollutants list was developed by using an understanding of the fate and transport of categories of pollutant classes.

The combined pollutants method was selected for determination of WQE pollutants of concern because it allows for specific WMA goals to be addressed efficiently without overlooking 303(d) listed pollutants that may have a significant negative impact to receiving water quality. **Tables B.1** through **B.10** on the pages that follow depict the combined pollutants method of consolidating 2010 303(d) pollutants or stressors for each identified waterbody and the WQIP priority pollutant lists for those water bodies.

Table B.1: WQE Pollutants of Concern - Penasquitos Watershed Management Area, Penasquitos Hydrologic Unit

Information From WQIPs				Comments	
Waterbody Name	2010 303(d) Pollutant or Stressor List (WQIP Table 2-2)	Priority Pollutant List Pollutant or Stressor (WQIP Table 2-6 through 2-9)	Highest Priority WQIP (Table 2-10)	WQE Pollutants of Concern	Rationale
Miramar Reservoir	Total nitrogen as N	Eutrophic conditions (Total Nitrogen)	NA	Fecal Coliform, TSS, Total Nitrogen, Total Phosphorus	Los Penasquitos highest priority is sedimentation of the estuary, which TSS applies most strongly to. Selenium is not based on any particular land use and retention at PDPs does not affect selenium discharges. The alternative compliance projects program would not be able to incentivize selenium actions in lieu of retention at PDPs.
Carroll Canyon Creek	NA	Enterococcus, Fecal Coliform	NA		
Soledad Canyon	Sediment toxicity, Selenium	Selenium, TDS	NA		
Poway Creek	Selenium, toxicity	Selenium, toxicity	NA		
Los Penasquitos Creek	Enterococcus, fecal coliform, selenium, TDS, total nitrogen as N, Toxicity	Enterococcus, fecal coliform, TDS, Eutrophic (total nitrogen), Eutrophic (total phosphorus and dissolved phosphorus), Toxicity	NA		
Los Penasquitos Lagoon	Sedimentation and siltation	Sedimentation and siltation, freshwater discharges, Hydromodification, TDS, Enterococcus, Fecal Coliform	Sedimentation and siltation, freshwater discharges, Hydromodification		
Pacific Ocean Shoreline at Torrey Pines State Beach at Del Mar	Enterococcus, fecal coliform, total coliform	Enterococcus, fecal coliform, total coliform	Indicator Bacteria		
Pacific Ocean Shoreline at Los Peñasquitos River Mouth	Total coliform	NA	NA		

Table B.2: WQE Pollutants of Concern – Mission Bay Watershed Management Area, Penasquitos Hydrologic Unit

WQIP Information				Comments	
Waterbody Name	2010 303(d) Pollutant or Stressor List (WQIP Table 2-2)	Priority Pollutant List Pollutant/Stressor (WQIP Table 2-6 through 2-8)	Highest Priority (WQIP Table 2-9)	WQE Pollutants of Concern	Rationale
Pacific Ocean Shoreline, Avenida de la Playa	Total coliform	Total coliform	Indicator Bacteria	Fecal Coliform, TSS, Total Phosphorous, Total Nitrogen	The WQIP narrowed the priority pollutant list down to bacteria, TSS, TDS, Toxicity, copper. Copper was only a priority in the ASBS and was not considered as a 303(d) pollutant. BMPs that remove TSS will also remove a fair amount of copper. TDS is not related to a particular land use. Toxicity has not been associated with a specific pollutant. TSS and fecal coliform BMPs can potentially reduce toxicity. Selenium is not specific to a land use.
Pacific Ocean Shoreline, Children's Pool	*Enterococcus*, total coliform, fecal coliform	Enterococcus, total coliform, fecal coliform	Indicator Bacteria		
Pacific Ocean Shoreline, La Jolla Cove	Total coliform	Total coliform	NA		
Pacific Ocean Shoreline, Pacific Beach Point	*Enterococcus*, total coliform, fecal coliform	*Enterococcus*, total coliform, fecal coliform	NA		
Pacific Ocean Shoreline, Ravina	Total coliform	Total coliform	Indicator Bacteria		
Pacific Ocean Shoreline, Vallecitos Court	Total coliform	Total coliform	Indicator Bacteria		
Mission Bay Shoreline, Bahia Point	*Enterococcus*, total coliform, fecal coliform	Enterococcus, Fecal Coliform	NA		
Mission Bay Shoreline, Bonita Cove	*Enterococcus,* total coliform, fecal coliform	Fecal coliform	NA		
Mission Bay Shoreline, Fanuel Park	Total coliform, Enterococcus	Enterococcus	NA		
Mission Bay, mouth of Rose Creek	Eutrophic, lead	Eutrophic, lead	NA		
Mission Bay Shoreline, Campland	*Enterococcus*, total coliform, fecal coliform	Total coliform			
Mission Bay Shoreline, De Anza Cove	*Enterococcus*, total coliform, fecal coliform	Fecal coliform	NA		
Mission Bay Shoreline, Leisure Lagoon	*Enterococcus*, total coliform	Enterococcus			
Mission Bay Shoreline, North Crown Point	*Enterococcus*, total coliform	*Enterococcus*, total coliform	NA		
Mission Bay Shoreline, Visitors Center	*Enterococcus*, total coliform, fecal coliform	Total coliform, fecal coliform			
Rose Creek	Selenium, toxicity	Toxicity, TDS, TSS	NA		
Mission Bay, mouth of Tecolote Creek	Eutrophic, lead	NA			
Tecolote Creek	Indicator bacteria, cadmium, copper, lead, phosphorus, toxicity, turbidity, zinc, nitrogen, selenium	Indicator Bacteria (total coliform, Enterococcus, fecal coliform), Potential Eutrophic Conditions (Phosphorus), Turbidity	Indicator Bacteria		
Mission Bay, Quivira Basin	Copper	NA	NA		
Mission Bay Shoreline, Tecolote Shores	*Enterococcus*, total coliform	Enterococcus	NA		
Area of Special Biological Significance (ASBS)	NA	Fecal coliform, total coliform, copper, sediment	Indicator Bacteria		

Table B.3: WQE Pollutants of Concern – San Dieguito River Watershed Management Area, San Dieguito Hydrologic Unit

WQIP Information				Comments	
Waterbody Name	2010 303(d) Pollutant or Stressor List (WQIP Table 2-2)	Priority Pollutant List Pollutant or Stressor (WQIP Table 2-6 through 2-8)	Highest Priority (WQIP Table 2-9)	WQE Pollutants of Concern	Rationale
Santa Ysabel Creek, Upper	Toxicity	NA	NA	Fecal Coliform, Total Nitrogen, Total Phosphorus	Color, pH, manganese, mercury, and iron are primarily in the reservoirs, which are drinking water reservoirs. The potable system achieves the maximum contaminant levels for these constituents through treatment. Color, pH, mercury are not associated with specific land uses and, therefore, alternative compliance project locations cannot be prioritized based on those pollutants. Manganese and iron are aesthetic standards for drinking water systems and removed through treatment. TDS, color, aluminum, PCP, are not related to any particular land use. Aluminum and PCP may be more related to legacy issues and bound in stream sediments. It would not be possible to incentivize land-use based alternative compliance projects placement on the basis of those pollutants. Selenium is not based on any particular land use and retention at PDPs does not affect selenium discharges. The alternative compliance projects program would not be able to incentivize selenium actions in lieu of retention at PDPs.
Sutherland Reservoir	Color, manganese, and pH, total nitrogen as N, iron	Color	NA		
Cloverdale Creek	TDS and phosphorus	TDS and Eutrophic conditions (phosphorus)	NA		
Green Valley Creek	Sulfates, chloride, manganese, and pentachlorophenol (PCP)	Sulfates, chloride	NA		
Kit Carson Creek	TDS and PCP	TDS	NA		
Felicita Creek	TDS and aluminum	TDS	NA		
Lake Hodges	Phosphorus, Color, nitrogen, turbidity, manganese, mercury, and pH	Fecal coliform, Enterococcus, Color, Eutrophic Conditions (Nitrogen and Phosphorus)	Indicator Bacteria		
San Dieguito River	Enterococcus, fecal coliform, nitrogen, phosphorus, TDS, and toxicity	Indicator Bacteria (Enterococcus and fecal coliform), Toxicity, TDS, Eutrophic conditions (Nitrogen)	NA		
Pacific Ocean Shoreline at San Dieguito Lagoon Mouth	Enterococcus, fecal coliform, total coliform	Indicator bacteria(Enterococcus and fecal coliform)	NA		

Table B.4: WQE Pollutants of Concern – Carlsbad Watershed Management Area, Carlsbad Hydrologic Unit

Information From WQIPs				Comments	
Waterbody Name	**2010 303(d) Pollutant or Stressor List (WQIP Table 3)**	**Priority Pollutant List Pollutant or Stressor (WQIP Table 5)**	**Highest Priority (WQIP Table 6)**	**WQE Pollutants of Concern**	**Rationale**
Loma Alta Creek	Selenium, Toxicity, Indicator Bacteria	Toxicity	NA	Fecal Coliform, Total Nitrogen, Total Phosphorus, TSS.	DDT, DDE are likely legacy and associated with sediments and not a particular land use. Selenium is not associated with a land use. Toxicity is not defined. Removing TSS and fecal coliform may reduce toxicity. TDS is not associated with a land use. Manganese is an aesthetic standard for drinking water systems and removed during treatment.
Loma Alta Slough	Eutrophic, Indicator Bacteria	Eutrophic, Indicator Bacteria	Eutrophic		
Pacific Ocean Shoreline @ Loma Alta Creek Mouth	Indicator Bacteria	Indicator bacteria	NA		
Buena Vista Lagoon	Indicator Bacteria, Nutrients, Sedimentation/ Siltation	Indicator Bacteria, Nutrients, Sedimentation/ Siltation	Indicator Bacteria		
Agua Hedionda Creek	Enterococcus, Fecal Coliform, Manganese, Phosphorus, Selenium, TDS, Total Nitrogen as N, Toxicity	Indicator bacteria, Toxicity, Nutrients, Sediment-Erosion-Hydromod	Indicator Bacteria		
Buena Creek	DDT, Nitrate	Nitrate and Nitrite	NA		
Cottonwood Creek	DDT, Sediment Toxicity, Selenium	NA	NA		
Encinitas Creek	NA	Toxicity	NA		
San Marcos Creek	DDE, Phosphorus, Sediment Toxicity, Selenium	Phosphorus	NA		
San Marcos Lake	Ammonia as N, Nutrients	Nutrients	NA		
Pacific Ocean Shoreline @ M	Total Coliform	NA	Indicator Bacteria		
Escondido Creek	DDT, Enterococcus, Fecal Coliform, Manganese, Phosphate, Selenium, Sulfate, TDS, Total Nitrogen as N,	Indicator Bacteria, Toxicity, Nutrients	Indicator Bacteria		
San Elijo Lagoon	Total Coliform, Eutrophic, Indicator Bacteria, Sedimentation/Siltation	Sedimentation/Siltation, Eutrophic	Indicator Bacteria		
Pacific Ocean Shoreline @ Sa	Total Coliform	NA	NA		
Pacific Ocean Shoreline	NA	Indicator Bacteria	NA		

Table B.5: WQE Pollutants of Concern – Tijuana River Watershed Management Area, Tijuana River Hydrologic Unit

Information From WQIPs				Comments	
Waterbody Name	2010 303(d) Pollutant or Stressor List (WQIP Table 2-2)	Priority Pollutant List Pollutant or Stressor (WQIP Table 2-6)	Highest Priority (WQIP Table 2-10)	WQE Pollutants of Concern	Rationale
Pacific Ocean Shoreline, Tijuana HU, at 3/4 mile north of Tijuana River	Total coliform, Fecal coliform, Enterococcus	NA	NA	Fecal Coliform, TSS, Total Nitrogen, Total Phosphorus	Color, pH, and manganese, are primarily in the reservoirs, which are drinking water reservoirs. The potable system achieves the maximum contaminant levels for these constituents through treatment. Color, pH, manganese are not associated with specific land uses and, therefore, alternative compliance projects locations cannot be prioritized based on those pollutants. BMPs that remove TSS will also remove a fair amount of metals. TSS and fecal coliform BMPs can potentially reduce other pollutants. Selenium is not based on any particular land use and retention at PDPs does not affect selenium discharges. The alternative compliance projects program would not be able to incentivize selenium actions in lieu of retention at PDPs.
Pacific Ocean Shoreline, Tijuana HU, at end of Seacoast Drive	Total coliform, Fecal coliform, Enterococcus	NA	NA		
Pacific Ocean Shoreline, Tijuana HU, at Monument Road	Total coliform, Fecal coliform	NA	NA		
Pacific Ocean Shoreline, Tijuana HU, at the US Border	Total coliform, Fecal coliform, Enterococcus	NA	NA		
Pacific Ocean Shoreline, Tijuana HU, at Tijuana River mouth	Total coliform, Fecal coliform, Enterococcus	NA	NA		
Pacific Ocean Shoreline	NA	Indicator bacteria	NA		
Tijuana River	Indicator bacteria, Solids, Sedimentation/Siltation, Trash, Total nitrogen as N, Phosphorus, Eutrophic, Low dissolved oxygen, Pesticides, Surfactants (MBAS), Selenium, Trace elements, synthetic organics, Toxicity	Indicator bacteria, Solids, TSS, Turbidity, Sedimentation/Siltation, Trash, Low dissolved oxygen, Pesticides, Surfactants (MBAS), Synthetic organics, Toxicity, nutrients	Sedimentation/Siltation/ Solids/TSS, Turbidity		
Tijuana River Estuary	Indicator bacteria, Turbidity, Trash, Eutrophic, Low dissolved oxygen, Pesticides, Lead, Nickel, Thallium	Turbidity, Indicator bacteria, Low dissolved oxygen, Trash	Turbidity		
Campo Creek	NA	Indicator Bacteria, Nutrients, TDS	NA		
Tecate Creek	Selenium	NA	NA		
Barrett Lake	Total Nitrogen as N, Manganese, Perchlorate, Color, pH	Nutrients	NA		
Pine Valley Creek (Upper)	Turbidity	NA	NA		
Morena Reservoir	Ammonia as Nitrogen, Phosphorus, Manganese, Color, pH	Nutrients	NA		
Cottonwood Creek	Selenium	NA	NA		

Table B.6: WQE Pollutants of Concern – San Diego River Watershed Management Area, San Diego Hydrologic Unit

Information From WQIPs				Comments	
Waterbody Name	**2010 303(d) Pollutant or Stressor List (WQIP Appendix A, Table 1)**	**Priority Pollutant List Pollutant or Stressor (WQIP Appendix D)**	**Highest Priority (WQIP Appendix D)**	**WQE Pollutants of Concern**	**Rationale**
Alvarado Creek	Selenium	Selenium	NA	Fecal Coliform, Total Nitrogen, Total Phosphorus	Color, pH, manganese, sulfates, and chloride are primarily in the lake and reservoirs, which are drinking water reservoirs. The potable system achieves the maximum contaminant levels for these constituents through treatment. Those pollutants are not associated with specific land uses and, therefore, alternative compliance project locations cannot be prioritized based on those pollutants. TDS, trash, and Selenium are not related to any particular land use. Toxicity is not defined. It would not be possible to incentivize land-use based alternative compliance project placement on the basis of those pollutants.
Famosa Slough and Channel	Eutrophic	Eutrophic	NA		
Forester Creek	Fecal coliform, Selenium, TDS, pH	Indicator bacteria, Selenium, TDS,	Indicator Bacteria		
Los Coches Creek	Selenium	Selenium	NA		
Murray Reservoir	Nitrogen, pH	Nitrogen, pH	NA		
Pacific Ocean Shoreline, San Diego HU, at the San Diego River outlet, at Dog Beach	Enterococcus, Total coliform	Enterococcus, Total coliform	Indicator Bacteria		
San Diego River (Lower)	Enterococcus, Fecal Coliform, Low dissolved oxygen, Manganese, Nitrogen, Phosphorus, TDS, Toxicity	Enterococcus, Fecal Coliform, Low dissolved oxygen, Manganese, Nitrogen, Phosphorus, TDS, Toxicity, IBI, Hydromodification, Trash	Indicator Bacteria		
El Capitan Lake	Color, Manganese, Phosphorus, Total Nitrogen as N, pH	Color, Manganese, Phosphorus, Total Nitrogen as N, pH	NA		
San Vicente Creek (San Diego County)	Ammonia as Nitrogen, Benthic community effects, Total nitrogen as N, Toxicity	Ammonia as Nitrogen, Benthic community effects, Total nitrogen as N, Toxicity	NA		
San Vicente Reservoir	Chloride, Color, Sulfates, Total nitrogen as N, pH (high)	Chloride, Color, Sulfates, Total nitrogen as N, pH (high)	NA		

Table B.7: WQE Pollutants of Concern – San Luis Rey River Watershed Management Area, San Luis Rey Hydrologic Unit

Information From WQIPs				Comments	
Waterbody Name	2010 303(d) Pollutant or Stressor List (WQIP Appendix A)	Priority Pollutant List Pollutant or Stressor (WQIP Appendix D)	Highest Priority (WQIP Appendix D)	WQE Pollutants of Concern	Rationale
Guajome Lake	Eutrophic	Eutrophic	NA	Fecal Coliform, Total Nitrogen, Total Phosphorus	TDS and Selenium are not related to any particular land use. Toxicity is not defined. It would not be possible to incentivize land-use based alternative compliance projects placement on the basis of those pollutants.
Keys Creek	Selenium	Selenium	NA		
Pacific Ocean Shoreline, San Luis Rey HU, At San Luis Rey River Mouth	Enterococcus, Total coliform	Enterococcus, Total coliform	Indicator Bacteria		
San Luis Rey River, Lower (West of Interstate 15)	Chloride, Enterococcus, Fecal Coliform, Phosphorus, TDS, Total Nitrogen as N, Toxicity	Chloride, Enterococcus, Fecal Coliform, Phosphorus, TDS, Total Nitrogen as N, Toxicity, IBI, Trash	Indicator Bacteria		
San Luis Rey River, Upper (East of Interstate 15) - Lower San Luis HA Subwatershed	Total Nitrogen as N	Total Nitrogen as N	NA		
San Luis Rey River, Upper (East of Interstate 15) - Monserate HA Subwatershed	Total Nitrogen as N	Total Nitrogen as N, Hydromodification	NA		

Table B.8: WQE Pollutants of Concern – San Diego Bay Watershed Management Area, Pueblo Hydrologic Unit

Information From WQIPs			Comments	
Waterbody Name	2010 303(d) Pollutant or Stressor List (Appendix D, 2010 303(d) listed only)	Priority Pollutant List Pollutant or Stressor (Apx H: Highest Priority WQ Evaluation)	WQE Pollutants of Concern	Rationale
Pacific Ocean Shoreline, Point Loma HA, at Bermuda	Total coliform	NA	Fecal Coliform, Total Nitrogen, Total Phosphorus, Total Copper, Total Zinc, Total Lead	TDS, color, aluminum, PCB, PAHs, are not related to any particular land use. It would not be possible to incentivize land-use based alternative compliance projects placement on the basis of those pollutants.
San Diego Bay Shelter Island Yacht Basin	Copper	Metals (Dissolved copper)		
San Diego Bay Shoreline, at Harbor Island (West Basin)	Copper	NA		
San Diego Bay Shoreline, near sub base	Benthic community effects, Sediment toxicity, Toxicity	NA		
San Diego Bay Shoreline, near Shelter Island Shoreline Park	Enterococcus, fecal coliform, total coliform	Bacteria		
Chollas Creek	Copper, Zinc, Lead, Diazinon, Phosphorus, Total nitrogen as N, Indicator bacteria, Trash	Metals (Dissolved Copper, zinc, and lead), Bacteria, Diazinon, Nutrients (Phosphorus, Total Nitrogen), Trash, PAHs, Chlordane, PCBs		
San Diego Bay Shoreline, 32nd St San Diego Naval Station	Benthic community effects, Sediment toxicity	NA		
San Diego Bay Shoreline, at Harbor Island (East Basin)	Copper	NA		
San Diego Bay Shoreline, at Marriott Marina	Copper	NA		
San Diego Bay Shoreline, at Spanish Landing	Total coliform	NA		
San Diego Bay Shoreline, between Sampson and 28th Streets	Copper, PAHs, Mercury, PCBs, Zinc	NA		
San Diego Bay Shoreline, Downtown Anchorage	Benthic community effects, Sediment toxicity	NA		
San Diego Bay Shoreline, G Street Pier	Total coliform	NA		
San Diego Bay Shoreline, near Chollas Creek	Benthic community effects, Sediment toxicity	NA		
San Diego Bay Shoreline, near Coronado Bridge	Benthic community effects, Sediment toxicity	NA		
San Diego Bay Shoreline, near Switzer Creek	Benthic community effects, Sediment toxicity, Chlordane	PAHS, PCBs, Chlordane		
San Diego Bay Shoreline, Vicinity of B St and Broadway Piers	Total coliform, Benthic community effects, Sediment toxicity	NA		
Switzer Creek	Copper, Lead, Zinc	NA		
Paleta Creek	Copper, Lead	PAHS, PCBs, Chlordane		
San Diego Bay Shoreline, North of 24th Street Marine Terminal	Benthic community effects, Sediment toxicity	NA		
San Diego Bay Shoreline, Seventh Street Channel	Benthic community effects, Sediment toxicity	NA		

Table B.9: WQE Pollutants of Concern – San Diego Bay Watershed Management Area, Sweetwater Hydrologic Unit

Information From WQIPs			Comments	
Waterbody Name	2010 303(d) Pollutant or Stressor List (Appendix D, 2010 303(d) listed only)	Priority Pollutant List Pollutant or Stressor (Appendix H: Highest Priority Water Quality Conditions Evaluation)	WQE Pollutants of Concern	Rationale
Paradise Creek	Selenium	NA	Fecal Coliform, Total Nitrogen, Total Phosphorus, Total Copper	Color, pH, aluminum, and manganese, are primarily in the reservoirs, which are drinking water reservoirs. The potable system achieves the maximum contaminant levels for these constituents through treatment. Color, pH, aluminum are not associated with specific land uses and, therefore, alternative compliance project locations cannot be prioritized based on those pollutants. TDS, color, aluminum, PCB, PAHs, are not related to any particular land use. It would not be possible to incentivize land-use based alternative compliance projects placement on the basis of those pollutants. Selenium is not based on any particular land use and retention at PDPs does not affect selenium discharges. The alternative compliance projects program would not be able to incentivize selenium actions in lieu of retention at PDPs.
Lower Sweetwater River, below Sweetwater Reservoir	Enterococcus, Fecal coliform, Selenium, Toxicity, Nitrogen, Phosphorus, TDS	Bacteria, TDS, Nutrients, Trash		
San Diego Bay Shoreline, at Bayside Park (J Street)	Enterococcus, Total coliform	NA		
San Diego Bay Shoreline, Chula Vista Marina	Copper	NA		
Sweetwater River MLS	Toxicity to S. capricornutum, Elevated salinity, Low O/E, California Rapid Assessment Method scores	NA		
Telegraph Canyon Creek	Selenium	NA		
Sweetwater Reservoir	Low DO	NA		
Sweetwater River TWAS	Toxicity to S. capricornutum acute	NA		
Loveland Reservoir	pH, Aluminum, Manganese, Low DO	NA		

Table B.10: WQE Pollutants of Concern – San Diego Bay Watershed Management Area, Otay Hydrologic Unit

<table>
<tr><th colspan="3">Information From WQIPs</th><th colspan="2">Comments</th></tr>
<tr><th>Waterbody Name</th><th>2010 303(d) Pollutant or Stressor List (Appendix D, 2010 303(d) listed only)</th><th>Priority Pollutant List Pollutant or Stressor (Appendix H: Highest Priority Water Quality Conditions Evaluation)</th><th>WQE Pollutants of Concern</th><th>Rationale</th></tr>
<tr><td>Pacific Ocean Shoreline, Coronado HA, at Silver Strand (north end, Oceanside)</td><td>Enterococcus</td><td>NA</td><td rowspan="10">Fecal Coliform, Total Nitrogen, TSS, Total Copper</td><td rowspan="10">Color, pH, aluminum, and manganese, are primarily in the reservoirs, which are drinking water reservoirs. The potable system achieves the maximum contaminant levels for these constituents through treatment. Color, pH, aluminum are not associated with specific land uses and, therefore, alternative compliance project locations cannot be prioritized based on those pollutants.

TDS, color, aluminum, PCB, PAHs, are not related to any particular land use. It would not be possible to incentivize land-use based alternative compliance projects placement on the basis of those pollutants.</td></tr>
<tr><td>Pacific Ocean Shoreline, Imperial Beach Pier</td><td>Fecal coliform, Total coliform, PCBs</td><td>NA</td></tr>
<tr><td>Pacific Ocean Shoreline, Otay Valley HA, at Carnation Ave and Camp Surf Jetty</td><td>Total coliform</td><td>NA</td></tr>
<tr><td>San Diego Bay Shoreline, at Coronado Cays</td><td>Copper</td><td>NA</td></tr>
<tr><td>San Diego Bay Shoreline, at Glorietta Bay</td><td>Copper</td><td>NA</td></tr>
<tr><td>San Diego Bay Shoreline, Tidelands Park</td><td>Enterococcus, Total coliform</td><td>NA</td></tr>
<tr><td>Otay River</td><td>Poor IBI, Toxicity to C. dubia acute and chronic
Survival and reproduction, Elevated dissolved copper, cyfluthrin, and TSS</td><td>Trash</td></tr>
<tr><td>Poggi Canyon Creek</td><td>Toxicity</td><td>NA</td></tr>
<tr><td>Jamul Creek</td><td>Toxicity</td><td>NA</td></tr>
<tr><td>Lower Otay Reservoir</td><td>High pH, Ammonia, Color, Iron, Manganese, Nitrogen</td><td>NA</td></tr>
</table>

B.1.2. Determination of Relative Pollutant Concentrations by Land Use

In order to facilitate consistent application of land use factor calculations, this guidance document has derived relative pollutant concentration values for WQE pollutants of concern across all land use categories for which EMC data is available. Derivation of the relative pollutant concentration values was executed in three steps. First, EMC data from San Diego River and San Luis Rey WQIPs was obtained. Second, the published EMC values were adjusted toward the mean pollutant concentration with equivalent proportionality. Lastly, the adjusted EMC values were translated into a relative pollutant concentration value between 0.10 and 1.00. These steps are discussed in further detail below. Please note that this is reference text only and that these steps do not need to be performed by applicants

Step 1:

EMC data from the San Diego River and San Luis Rey WQIPs was used to identify the average concentrations for all potential WQE pollutants of concern with respect to tributary land uses. This EMC data largely corresponds with default values from the Los Angeles Region Structural BMP Prioritization Tool, but has been modified as stated below to better represent values anticipated for the San Diego Region.

Table B.11: EMC Values for WQE Pollutants of Concern by Land Use Category

Land Use Category	TSS (mg/L)	TP (mg/L)	TN (mg/L)	TCu (ug/L)	TPb (ug/L)	TZn (ug/L)	FC (#/100mL)
Agriculture	999.20	3.34	43.37	100.10	30.20	274.80	60,300
Commercial	127.68	0.32	5.20	54.84	14.40	483.70	51,600
Education	132.11	0.46	2.72	12.02	7.43	174.10	2,148
Industrial	125.18	0.45	4.34	53.54	20.52	428.39	26,703
Multi -Family Residential	39.90	0.23	3.81	12.10	4.50	125.10	11,800
Orchard	252.64	0.36	28.46	100.10	30.20	274.80	1,344
Rural Residential	2523.76	1.59	4.26	8.36	21.38	39.19	6,684
Single Family Residential	123.41	0.49	4.58	25.96	13.03	153.29	35,557
Transportation	77.80	0.68	2.95	52.20	9.20	292.90	1,680
Vacant / Open Space	216.60	0.12	2.24	10.60	3.00	26.30	484
Water	0.00	0.00	0.00	0.00	0.00	0.00	0

Modifications:

1. TN represents the summation of individual NH_3, NO_3, and TKN listings.
2. Dissolved elements are not expressly included in this list as total elements include dissolved elements within the analytical result.
3. FC is used as a surrogate for indicator bacteria including total coliform and enterococcus.
4. Underlined values are based on Los Angeles region default Structural BMP Prioritization and Analysis Tool (SBPAT) datasets due to a lack of available San Diego data.
5. EMC data was not available for water; however, this guidance has assigned an average pollutant concentration runoff value of 0.00 to effectively exclude pollutant runoff from waterbodies.

Step 2:

Initial methods for determining land use factors simply referenced the raw EMC pollutant concentrations from Step 1 into subsequent land use factor calculations; however, extreme variations in the EMC data were found to generate land use factors that impacted the WQE results by up to two orders of magnitude. For example, if an ACP tributary consisting of entirely rural residential land use was used to offset a PDP tributary consisting of entirely multi-family residential land use, the resulting land use factor for TSS would be calculated as 63.2. (2523.76/39.90 = 63.2). Conversely, if the ACP tributary was entirely multi-family residential and the PDP tributary was entirely rural residential, the resulting land use factor for TSS would be calculated as 0.015. The TAC concluded that such extreme variations were too powerful for incorporation into the WQE formula and that the EMC data should be adjusted to produce more reasonable results.

Although published EMC values are the best data available, the TAC concluded that it is simply not accurate enough to justify WQE impacts to two orders of magnitude. Secondly, even if the data was extremely accurate, there is still a need to account for potential uncertainties introduced through the correlation of detailed land uses (188) with the highly generalized EMC land use categories (11). Finally, failing to limit the most extreme land use factors would produce the greatest location incentives and disincentives based on the most extreme and arguably the least accurate datasets.

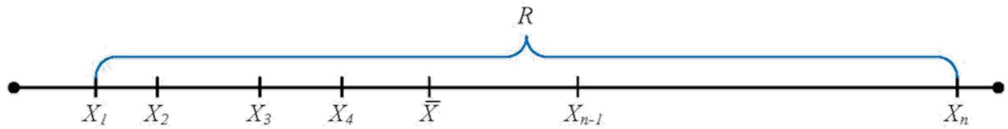
Ultimately, the EMC data for each pollutant was adjusted by scaling all values toward the mean with equivalent proportionality such that the land use factor would never produce results outside of a range from 0.10 to 10.00. This adjustment effectively limits the maximum impact of the land use factor in WQE calculations to one order of magnitude. The adjusted EMCs are depicted in **Table B.12** below and the scaling methodology is presented on the pages that follow.

Table B.12: Adjusted EMCs Scaled Toward Mean with Equivalent Proportionality

Land Use Category	TSS (mg/L)	TP (mg/L)	TN (mg/L)	TCu (ug/L)	TPb (ug/L)	TZn (ug/L)	FC (#/100mL)
Agriculture	817.42	2.76	37.20	97.76	30.18	270.17	50,705
Commercial	240.71	0.43	6.13	54.35	14.40	458.72	44,068
Education	243.64	0.54	4.11	13.29	7.44	179.28	6,340
Industrial	239.06	0.53	5.43	53.11	20.51	408.80	25,074
Multi -Family Residential	182.63	0.36	5.00	13.36	4.52	135.05	13,704
Orchard	323.40	0.46	25.06	97.76	30.18	270.17	5,727
Rural Residential	1826.27	1.41	5.36	9.78	21.37	57.51	9,801
Single Family Residential	237.89	0.56	5.62	26.66	13.03	160.49	31,828
Transportation	207.71	0.71	4.30	51.82	9.21	286.51	5,983
Vacant / Open Space	299.55	0.28	3.72	11.92	3.02	45.87	5,071
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The methodology for scaling EMCs towards the mean with equivalent proportionality such that resultant land use factors are always within a range of 0.10 and 10.0 is presented below.

Consider n EMCs for n land uses plotted across a scale.



The range of EMCs is: $$R = X_n - X_1$$

Where:

$$X_n = \text{EMC}_{\max}$$

$$X_1 = \text{EMC}_{\min}$$

The average EMC represents the midpoint of the scale:

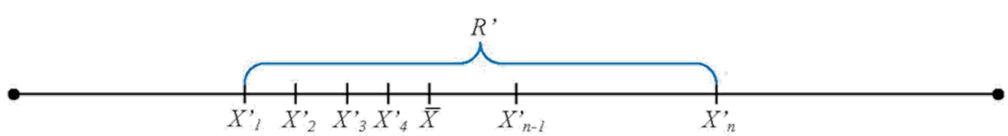
$$\overline{X} = \frac{1}{n}\sum_{i=1}^{i=n} X_i$$

The entire range of EMCs is to be compressed to the point where:

$$\frac{X'_n}{X'_1} \leq 10$$

Where: $X_n' < X_n$ And $X_1' > X_1$

While the proportional distance of all EMCs from each other remains constant. Since only the endpoints of the range change, the midpoint should remain constant.



To maintain the proportionality, the proportional distance from the mean needs to remain constant. This can be described by:

$$D_i = \frac{X_i - \overline{X}}{R}$$

This includes the minimum and maximum values.

$$D_1 = \frac{X_1 - \overline{X}}{R} \qquad D_n = \frac{X_n - \overline{X}}{R}$$

Maintaining proportionality means that Di remains constant

$$D_1 = \frac{X_1' - \overline{X}}{R'} \qquad D_n = \frac{X_n' - \overline{X}}{R'}$$

And

$$R' = X_n' - X_1'$$

Remembering that

$$\frac{X_n'}{X_1'} = 10 \qquad X_n' = 10X_1' \qquad R' = 10X_1' - X_1' = 9X_1'$$

Combining equations and solving for X'_1

$$\frac{X_1' - \overline{X}}{9X_1'} = \frac{X_1 - \overline{X}}{X_n - X_1}$$

$$X_1' = \frac{\overline{X}\left(X_1 - X_n\right)}{9\left(X_1 - \overline{X}\right) - \left(X_n - X_1\right)}$$

For all X'_i

$$D_i = \frac{X_i - \overline{X}}{X_n - X_1} = \frac{X'_i - \overline{X}}{9X_i'}$$

Solving for X'_i

$$X_i' = \frac{X_i - \overline{X}}{X_n - X_i} \times 9X_i' + \overline{X}$$

Combining into one equation for X'_i

$$X_i' = \frac{X_i - \overline{X}}{X_n - X_i} \times \frac{9\overline{X}\left(X_1 - X_n\right)}{9\left(X_1 - \overline{X}\right) - \left(X_n - X_1\right)_i} + \overline{X}$$

Step 3:

In order to simplify the user interface for calculating appropriate land user factors, the adjusted EMC values determined in Step 2 have been translated to a decimal value between 0.10 and 1.00. These unitless values identify the relative pollutant concentrations that each land use category produces for each WQE pollutant of concern. This translation was performed for each pollutant by dividing each of the adjusted pollutant concentrations by the maximum adjusted pollutant concentration for that pollutant.

To illustrate this process let's examine the TSS pollutant. The adjusted EMC values from Step 2 indicate that rural residential land uses produce the highest concentrations and multi-family residential land uses produce the lowest concentrations (1826.27 and 182.63 mg/L respectively). After dividing all adjusted TSS pollutant concentrations by the maximum value of 1826.27 mg/L, the relative TSS pollutant concentrations for rural residential and multi-family residential land uses translate to 1.00 and 0.10 respectively. The sole intent of this step is to simplify the land use factor user interface by presenting all pollutant data in the same range. These translations do not have any effect on the ultimate land use factors that are determined (i.e. 1826.27/182.63 = 10 and 1.00/0.10= 10). Relative pollutant concentrations for all WQE pollutants of concern across all land use categories are depicted in **Table B.13** below.

Table B.13: Relative Pollutant Concentrations by Land Use Category (unitless)

Land Use Category	TSS	TP	TN	TCu	TPb	TZn	FC
Agriculture	0.45	1.00	1.00	1.00	1.00	0.59	1.00
Commercial	0.13	0.16	0.16	0.56	0.48	1.00	0.87
Education	0.13	0.20	0.11	0.14	0.25	0.39	0.13
Industrial	0.13	0.19	0.15	0.54	0.68	0.89	0.49
Multi -Family Residential	0.10	0.13	0.13	0.14	0.15	0.29	0.27
Orchard	0.18	0.17	0.67	1.00	1.00	0.59	0.11
Rural Residential	1.00	0.51	0.14	0.10	0.71	0.13	0.19
Single Family Residential	0.13	0.20	0.15	0.27	0.43	0.35	0.63
Transportation	0.11	0.26	0.12	0.53	0.31	0.62	0.12
Vacant / Open Space	0.16	0.10	0.10	0.12	0.10	0.10	0.10
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00

B.1.3. Water Quality Equivalency Land Use Mapping

The WQE land use mapping published in this document has been developed by grouping available detailed SANGIS and SCAG land use mapping data into land use categories for which EMC data is available. SANGIS Land Use mapping dated October 2014 provides data for 104 SANGIS land uses within the Region 9 greater San Diego area and SCAG land use mapping dated from 2005 provides data for 84 SCAG land uses within Region 9 areas for Orange and Riverside Counties. However, because available EMC data is limited to 11 land use categories, it was necessary to correlate all detailed SANGIS and SCAG land uses with the 11 EMC land use categories before appropriate land use specific WQE pollutant of concern concentrations could be mapped. The correlations used in this analysis are depicted in **Table B.12** on the pages that follow and have been established through examination of similar correlation exercises performed through the WQIP mapping process and through utilization of good engineering judgment where necessary. EMC land use mapping is illustrated in **Figure B.1** below, but users may also reference the full size maps located in **Appendix D**, and ArcGIS information available for download on www.projectcleanwater.org.

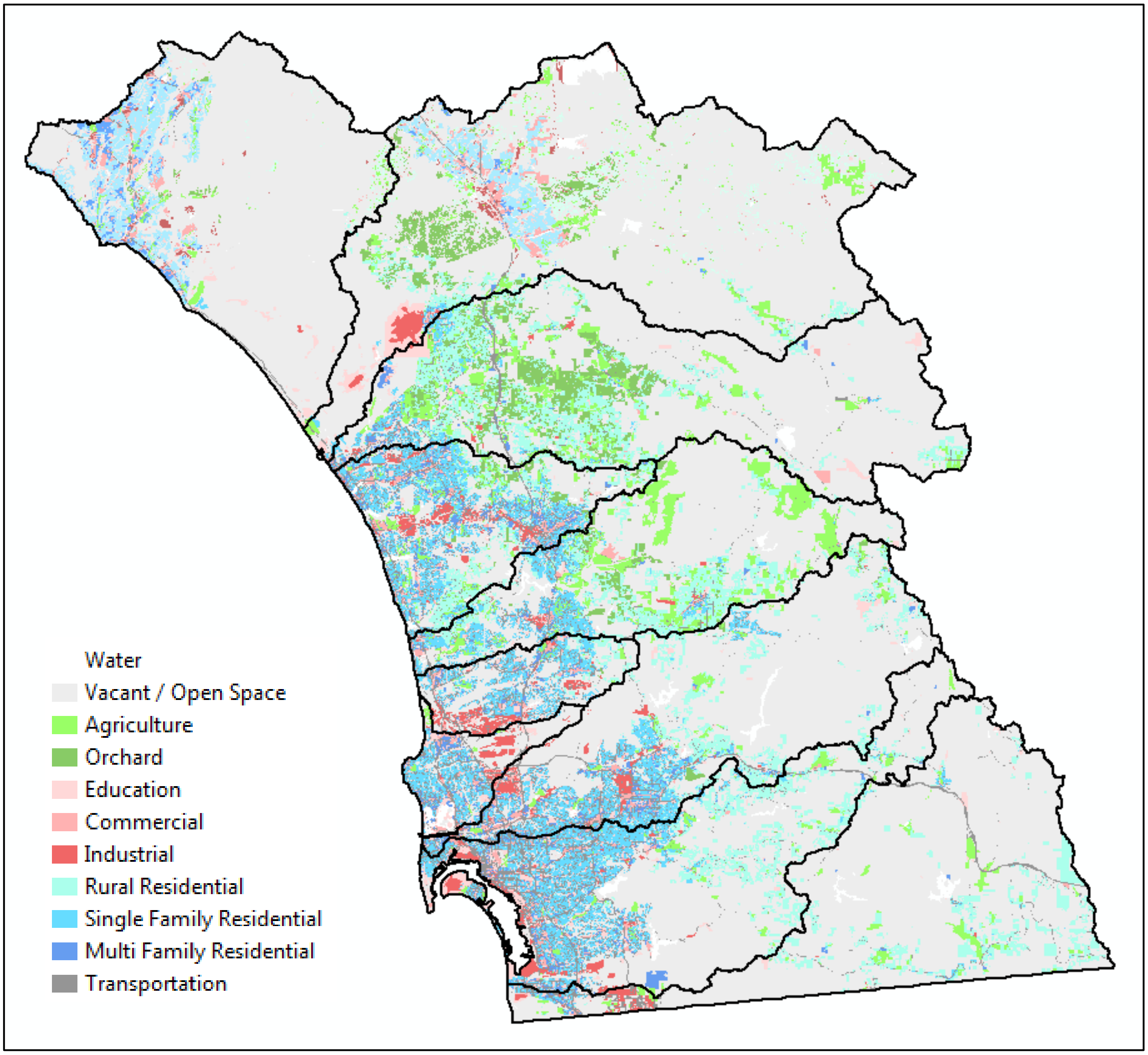


Figure B.1: EMC Land Use Mapping

Table B.14: EMC Land Use Correlations

Land Use Source	Land Use ID	Land Use Classification	Correlated EMC Land Use
SANGIS	1000	Spaced Rural Residential	Rural Residential
SANGIS	1110	Single Family Detached	Single Family Residential
SANGIS	1120	Single Family Multiple-Units	Single Family Residential
SANGIS	1190	Single Family Residential Without Units	Single Family Residential
SANGIS	1200	Multi-Family Residential	Multi Family Residential
SANGIS	1280	Single Room Occupancy Units (SRO's)	Education
SANGIS	1290	Multi-Family Residential Without Units	Multi Family Residential
SANGIS	1300	Mobile Home Park	Multi Family Residential
SANGIS	1401	Jail/Prison	Multi Family Residential
SANGIS	1402	Dormitory	Multi Family Residential
SANGIS	1403	Military Barracks	Education
SANGIS	1404	Monastery	Education
SANGIS	1409	Other Group Quarters Facility	Multi Family Residential
SANGIS	1501	Hotel/Motel (Low-Rise)	Multi Family Residential
SANGIS	1502	Hotel/Motel (High-Rise)	Multi Family Residential
SANGIS	1503	Resort	Multi Family Residential
SANGIS	2001	Heavy Industry	Industrial
SANGIS	2101	Industrial Park	Industrial
SANGIS	2103	Light Industry - General	Industrial
SANGIS	2104	Warehousing	Industrial
SANGIS	2105	Public Storage	Industrial
SANGIS	2201	Extractive Industry	Industrial
SANGIS	2301	Junkyard/Dump/Landfill	Industrial
SANGIS	4101	Commercial Airport	Industrial
SANGIS	4102	Military Airport	Industrial
SANGIS	4103	General Aviation Airport	Industrial
SANGIS	4104	Airstrip	Transportation
SANGIS	4111	Rail Station/Transit Center	Transportation
SANGIS	4112	Freeway	Transportation
SANGIS	4113	Communications and Utilities	Vacant / Open Space
SANGIS	4114	Parking Lot - Surface	Transportation
SANGIS	4115	Parking Lot - Structure	Transportation
SANGIS	4116	Park and Ride Lot	Transportation
SANGIS	4117	Railroad Right of Way	Transportation
SANGIS	4118	Road Right of Way	Transportation
SANGIS	4119	Other Transportation	Transportation
SANGIS	4120	Marine Terminal	Industrial
SANGIS	4210	Single Family Residential	Single Family Residential
SANGIS	5001	Wholesale Trade	Industrial
SANGIS	5002	Regional Shopping Center	Commercial
SANGIS	5003	Community Shopping Center	Commercial
SANGIS	5004	Neighborhood Shopping Center	Commercial

Land Use Source	Land Use ID	Land Use Classification	Correlated EMC Land Use
SANGIS	5005	Specialty Commercial	Commercial
SANGIS	5006	Automobile Dealership	Commercial
SANGIS	5007	Arterial Commercial	Commercial
SANGIS	5008	Service Station	Commercial
SANGIS	5009	Other Retail Trade and Strip Commercial	Commercial
SANGIS	6001	Office (High-Rise)	Commercial
SANGIS	6002	Office (Low-Rise)	Commercial
SANGIS	6003	Government Office/Civic Center	Commercial
SANGIS	6101	Cemetery	Education
SANGIS	6102	Religious Facility	Education
SANGIS	6103	Library	Education
SANGIS	6104	Post Office	Commercial
SANGIS	6105	Fire/Police Station	Commercial
SANGIS	6108	Mission	Vacant / Open Space
SANGIS	6109	Other Public Services	Commercial
SANGIS	6501	UCSD/VA Hospital/Balboa Hospital	Commercial
SANGIS	6502	Hospital - General	Commercial
SANGIS	6509	Other Health Care	Commercial
SANGIS	6701	Military Use	Education
SANGIS	6702	Military Training	Vacant / Open Space
SANGIS	6703	Weapons Facility	Industrial
SANGIS	6801	SDSU/CSU San Marcos/UCSD	Education
SANGIS	6802	Other University or College	Education
SANGIS	6803	Junior College	Education
SANGIS	6804	Senior High School	Education
SANGIS	6805	Junior High School or Middle School	Education
SANGIS	6806	Elementary School	Education
SANGIS	6807	School District Office	Education
SANGIS	6809	Other School	Education
SANGIS	7201	Tourist Attraction	Commercial
SANGIS	7202	Stadium/Arena	Commercial
SANGIS	7203	Racetrack	Commercial
SANGIS	7204	Golf Course	Agriculture
SANGIS	7205	Golf Course Clubhouse	Commercial
SANGIS	7206	Convention Center	Commercial
SANGIS	7207	Marina	Commercial
SANGIS	7208	Olympic Training Center	Commercial
SANGIS	7209	Casino	Commercial
SANGIS	7210	Other Recreation - High	Education
SANGIS	7211	Other Recreation - Low	Education
SANGIS	7601	Park - Active	Education
SANGIS	7603	Open Space Park or Preserve	Vacant / Open Space
SANGIS	7604	Beach - Active	Vacant / Open Space

Land Use Source	Land Use ID	Land Use Classification	Correlated EMC Land Use
SANGIS	7605	Beach - Passive	Vacant / Open Space
SANGIS	7606	Landscape Open Space	Vacant / Open Space
SANGIS	7607	Residential Recreation	Education
SANGIS	7609	Undevelopable Natural Area	Vacant / Open Space
SANGIS	8001	Orchard or Vineyard	Orchard
SANGIS	8002	Intensive Agriculture	Agriculture
SANGIS	8003	Field Crops	Agriculture
SANGIS	9101	Vacant and Undeveloped Land	Vacant / Open Space
SANGIS	9200	Water	Water
SANGIS	9201	Bay or Lagoon	Water
SANGIS	9202	Lake/Reservoir/Large Pond	Water
SANGIS	9501	Residential Under Construction	Single Family Residential
SANGIS	9502	Commercial Under Construction	Commercial
SANGIS	9503	Industrial Under Construction	Industrial
SANGIS	9504	Office Under Construction	Commercial
SANGIS	9505	School Under Construction	Education
SANGIS	9506	Road Under Construction	Transportation
SANGIS	9507	Freeway Under Construction	Transportation
SANGIS	9700	Mixed Use	Commercial
SCAG	1111	High-Density Single Family Residential	Single Family Residential
SCAG	1112	Low-Density Single Family Residential	Single Family Residential
SCAG	1121	Mixed Multi Family Residential	Multi Family Residential
SCAG	1122	Duplexes, Triplexes and 2-or 3-Unit Condominiums and Townhouses	Multi Family Residential
SCAG	1123	Low-Rise Apartments, Condominiums, and Townhouses	Multi Family Residential
SCAG	1124	Medium-Rise Apartments and Condominiums	Multi Family Residential
SCAG	1125	High-Rise Apartments and Condominiums	Multi Family Residential
SCAG	1131	Trailer Parks and Mobile Home Courts, High-Density	Multi Family Residential
SCAG	1132	Mobile Home Courts and Subdivisions, Low-Density	Multi Family Residential
SCAG	1140	Mixed Residential	Multi Family Residential
SCAG	1151	Rural Residential, High-Density	Rural Residential
SCAG	1152	Rural Residential, Low-Density	Rural Residential
SCAG	1211	Low- and Medium-Rise Major Office Use	Commercial
SCAG	1221	Regional Shopping Center	Commercial
SCAG	1222	Retail Centers (Non-Strip With Contiguous Interconnected Off-Street)	Commercial
SCAG	1223	Modern Strip Development	Commercial
SCAG	1224	Older Strip Development	Commercial
SCAG	1231	Commercial Storage	Commercial

Land Use Source	Land Use ID	Land Use Classification	Correlated EMC Land Use
SCAG	1232	Commercial Recreation	Commercial
SCAG	1233	Hotels and Motels	Multi Family Residential
SCAG	1241	Government Offices	Commercial
SCAG	1242	Police and Sheriff Stations	Commercial
SCAG	1243	Fire Stations	Commercial
SCAG	1244	Major Medical Health Care Facilities	Commercial
SCAG	1245	Religious Facilities	Commercial
SCAG	1246	Other Public Facilities	Commercial
SCAG	1247	Non-Attended Public Parking Facilities	Transportation
SCAG	1251	Correctional Facilities	Education
SCAG	1252	Special Care Facilities	Commercial
SCAG	1253	Other Special Use Facilities	Commercial
SCAG	1261	Pre-Schools/Day Care Centers	Education
SCAG	1262	Elementary Schools	Education
SCAG	1263	Junior or Intermediate High Schools	Education
SCAG	1264	Senior High Schools	Education
SCAG	1265	Colleges and Universities	Education
SCAG	1271	Base (Built Up Area)	Industrial
SCAG	1272	Vacant Area	Vacant / Open Space
SCAG	1311	Manufacturing, Assembly, and Industrial Services	Industrial
SCAG	1314	Research and Development	Commercial
SCAG	1323	Open Storage	Industrial
SCAG	1331	Mineral Extraction - Other Than Oil and Gas	Industrial
SCAG	1340	Wholesaling and Warehousing	Industrial
SCAG	1411	Airports	Industrial
SCAG	1412	Railroads	Transportation
SCAG	1413	Freeways and Major Roads	Transportation
SCAG	1414	Park and Ride Lots	Transportation
SCAG	1415	Bus Terminals and Yards	Transportation
SCAG	1416	Truck Terminals	Transportation
SCAG	1420	Communication Facilities	Vacant / Open Space
SCAG	1431	Electrical Power Facilities	Vacant / Open Space
SCAG	1432	Solid Waste Disposal Facilities	Industrial
SCAG	1433	Liquid Waste Disposal Facilities	Industrial
SCAG	1434	Water Storage Facilities	Industrial
SCAG	1435	Natural Gas and Petroleum Facilities	Industrial
SCAG	1436	Water Transfer Facilities	Industrial
SCAG	1437	Improved Flood Waterways and Structures	Water
SCAG	1440	Maintenance Yards	Industrial
SCAG	1450	Mixed Transportation	Transportation

Land Use Source	Land Use ID	Land Use Classification	Correlated EMC Land Use
SCAG	1460	Mixed Transportation and Utility	Transportation
SCAG	1500	Mixed Commercial and Industrial	Industrial
SCAG	1600	Mixed Urban	Commercial
SCAG	1700	Under Construction	Commercial
SCAG	1810	Golf Courses	Agriculture
SCAG	1821	Developed Local Parks and Recreation	Education
SCAG	1831	Developed Regional Parks and Recreation	Education
SCAG	1832	Undeveloped Regional Parks and Recreation	Vacant / Open Space
SCAG	1840	Cemeteries	Education
SCAG	1870	Beach Parks	Vacant / Open Space
SCAG	1880	Other Open Space and Recreation	Vacant / Open Space
SCAG	2110	Irrigated Cropland and Improved Pasture Land	Agriculture
SCAG	2120	Non-Irrigated Cropland and Improved Pasture Land	Vacant / Open Space
SCAG	2200	Orchards and Vineyards	Orchard
SCAG	2300	Nurseries	Orchard
SCAG	2400	Dairy, Intensive Livestock, and Associated Facilities	Agriculture
SCAG	2500	Poultry Operations	Agriculture
SCAG	2600	Other Agriculture	Agriculture
SCAG	2700	Horse Ranches	Agriculture
SCAG	3100	Vacant Undifferentiated	Vacant / Open Space
SCAG	3200	Abandoned Orchards and Vineyards	Orchard
SCAG	3300	Vacant With Limited Improvements	Vacant / Open Space
SCAG	3400	Beaches Vacant	Vacant / Open Space
SCAG	4100	Water, Undifferentiated	Water
SCAG	4200	Harbor Water Facilities	Water
SCAG	4300	Marina Water Facilities	Water

B.1.4. Independent ACP Reference Tributary Analysis

As discussed in **Section 2.3.1.2,** the land use factor (L) represents the ratio of relative pollutant concentrations generated by an ACP tributary with respect to the relative pollutant concentrations generated by a reference tributary. The reference tributary refers to the area that is analyzed in order to characterize the land use compositions and subsequent pollutant concentrations that will establish baseline pollutant concentrations for comparison to the ACP pollutant concentrations. For Applicant-Implemented ACPs, the reference tributary is the actual PDP tributary area since this area will have been identified as part of the project application and review process. For Independent ACPs, a PDP will not yet have been identified, so the applicable WMA is used as the reference drainage area.

In order to establish consistent data for use in Independent ACP land use factor calculations, this guidance document has performed a GIS analysis that identifies the land use compositions appropriate for use by Independent ACPs within each of the Region 9 WMAs. The text below outlines the methodologies used for this analysis, and **Table B.13** summarizes the data used. It should be noted that this text is provided for information purposes only and this analysis does not need to be performed on an individual project scale.

1. The EMC land use mapping developed as outlined in **Section B.1.3** was utilized as a starting point for this analysis.
2. In order to more accurately account for the types of PDPs that will likely seek out and purchase the credits generated by an Independent ACP, the EMC land use mapping was overlaid with additional mapping layers and augmented to remove areas identified to be unsupportive of PDPs including:
    a. Federal/State/Indian Lands
        i. San Diego County – SANGIS Federal/State/Indian Lands
        ii. Orange and Riverside Counties: CA Bureau of Land Management Land Status
    b. Multiple Species Conservation Plan (MSCP) Lands
        i. San Diego County – MSCP Lands
        ii. Orange County – Orange County Natural Community Conservation Planning Habitat Conservation Program (NCCP/HCP)
        iii. Riverside County – Riverside County Public/Quasi Public Conserved Lands and Regional Conservation Authority Multiple Species Habitat Conservation Plan
    c. EMC Land Use Mapping for Open Space and Water
3. Lastly, the remaining EMC land use mapping was clipped to each WMA boundary and associated EMC land use compositions for each WMA were established. These values are presented in **Table 2-3**.

Table B.15: GIS Data Used in Analysis

Dataset	Description
Watershed Management Areas	SANDAG/SANGIS Hydrologic Unit Mapping, April 2015 (clipped and combined to correspond with Region 9 WMAs)
San Diego County: Current Land Use Mapping	SANDAG/SANGIS Current Land Use, October 2014
San Diego County: State/Federal/Indian Lands	SANGIS/SANDAG Federal/State/Indian Lands, June 2014
Orange and Riverside County: Federal/State/Indian Lands	California Bureau of Land Management Land Status, 2015
San Diego County: MSCP Lands	SANDAG/SANGIS Adopted County MSCP, 2009; SANDAG/SANGIS Draft North County MSCP, June 2008; SANDAG/SANGIS Draft East County MSCP, February 2009; SANDAG/SANGIS Multi-Habitat Planning Areas, July 2012
Orange County: MSCP Lands	Orange County Natural Community Conservation Planning Habitat Conservation Program, December 2009
Riverside County: MSCP Lands	Riverside County Public/Quasi Public Conserved Lands, June 2003; Riverside County Regional Conservation Authority Multiple Species Habitat Conservation Plan, June 2003

B.2. BMP Efficacy Factor Supporting Material

The BMP efficacy factor (**B**) describes the ability of an ACP to remove pollutants in runoff from the drainage area. This factor is represented as a ratio and can vary from 0.00 to 1.00. A BMP efficacy factor of 1.00 indicates that an ACP provides a pollutant capture efficacy that meets or exceeds typical PDP efficacy standards set forth in the Permit, while a lower BMP efficacy factor value indicates that the ACP provides some fraction of pollutant capture efficacy set forth in the Permit.

The BMP efficacy factor is a function of two variables, the pollutant removal efficiency (**E**), and the provided capture (**C**). Supporting text for pollutant removal efficiencies is provided in **Section 2.3.1.3.1** of this guidance, supporting text for provided capture determination is provided below.

B.2.1. BMP Provided Capture

The provided capture (**C**) value accounts for the portion of BMPDM pollutant control sizing requirements that are satisfied by an ACP. Incorporation of this value into the WQE formula allows for quantification of the proportional water quality benefits provided by ACPs that do not fully accommodate the sizing criteria set forth by the BMPDM. Before such a determination can be made, it is necessary to develop a more fundamental understanding of how the BMPDM addresses stormwater pollutant control requirements set forth in the Permit.

First let's discuss retention-based stormwater pollutant reduction requirements. Section E.3.c.(1)(a) of the Permit states that each PDP must implement BMPs that are designed to retain the pollutants contained within the DCV but does not specify a drawdown time for such retention. Recognizing that a retention BMP with a fast drawdown time would capture a greater fraction of overall runoff than an identically sized retention BMP with a slow drawdown time, the BMPDM sought to establish a performance-based expression for the stormwater pollutant control requirements set forth in the Permit. In an effort to establish such an expression, the BMPDM performed continuous simulation modeling to evaluate relationships between retention BMP design parameters and expected long term capture efficiencies. These relationships are established in the form of percent capture curves which indicate that a retention BMP sized to retain the DCV and drawdown in 36 hours is capable of managing approximately 80 percent of the average annual rainfall. Therefore, the BMPDM equates the Permit requirements for onsite retention of stormwater pollutants within the DCV to providing retention BMPs capable of managing 80 percent of the average annual rainfall.

This WQE document converts the percent capture curves from the BMPDM into provided capture curves for use in the WQE formula by dividing all values by 0.80. This step is necessary for inclusion in WQE calculations as the intent of the WQE process is to demonstrate that an offsite ACP provides greater overall water quality benefit than fully satisfying onsite pollutant control requirements. Because the onsite requirement set forth in the BMPDM is to retain 0.80 of the average annual runoff, an offsite ACP retaining 0.80 of the average annual runoff is equivalent to what would have been provided by fully satisfying onsite requirements and therefore earns a provided capture of 1.00 rather than 0.80. As depicted in **Figure B.2**, the maximum provided capture value that can be achieved by a retention BMP is 1.00.

The Permit also allows for biofiltration-based stormwater pollutant control techniques. Section E.3.c.(1)(a)(i) of the Permit states that PDPs implementing biofiltration BMPs must be designed to treat 1.5 times the DCV not retained onsite, or to treat the DCV with a flow-thru design that is capable of holding at least 0.75 times the portion of the DCV not retained onsite. Again no drawdown times are specified by the permit; however, the BMPDM did not elect to establish more detailed performance-based expression for biofiltration-based BMPs. As illustrated in **Figure B.3**, the provided capture curves for biofiltration BMPs are simply a linear expression extending from 0.00 to 1.50.

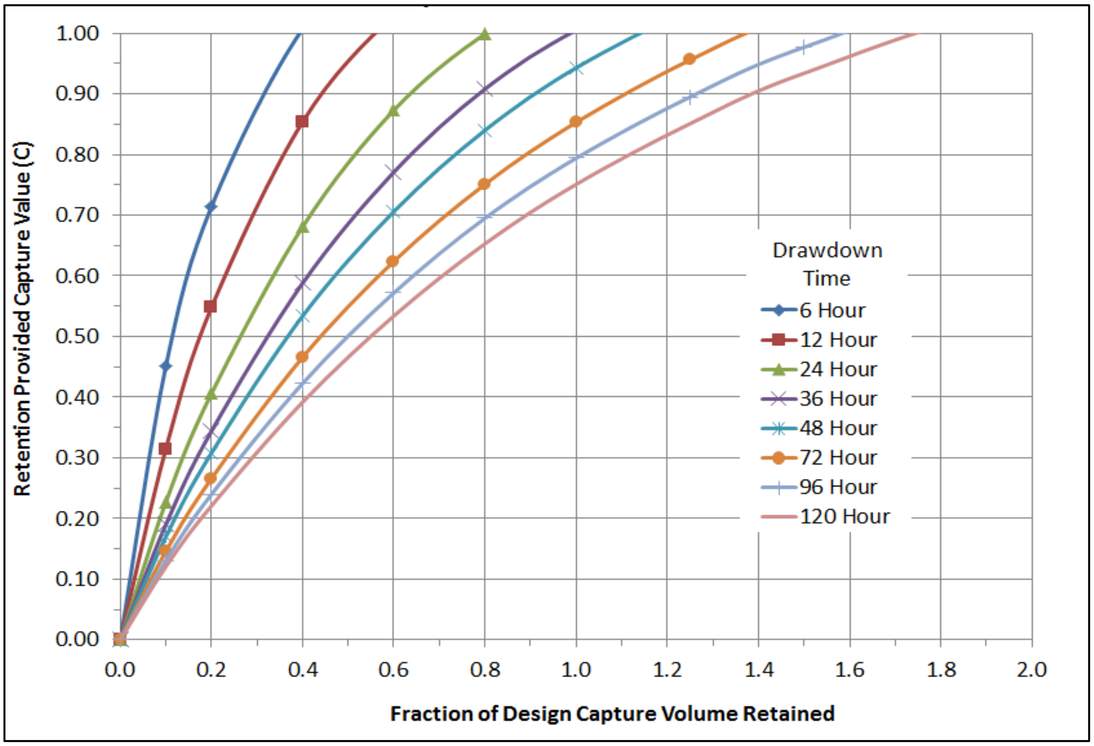


Figure B.3: Retention Provided Capture Curves

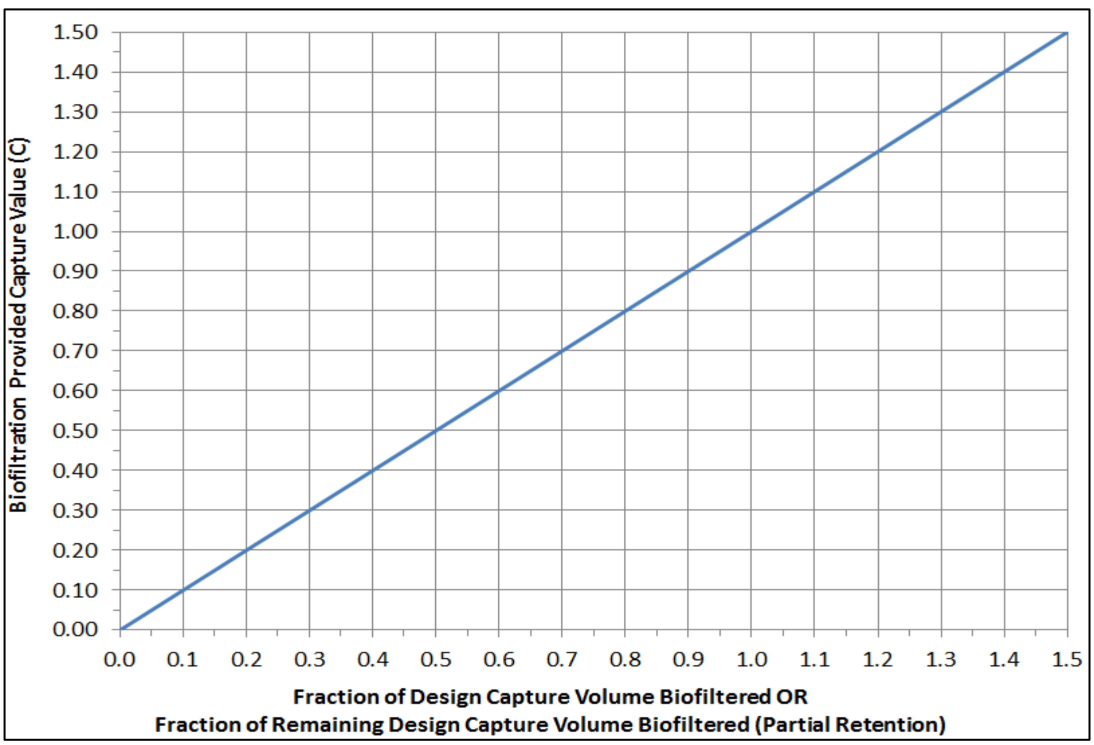


Figure B.2: Biofiltration Provided Capture Illustration

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Appendix C: WQE Hydromodification Flow Control Reference Information

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C.1. General Hydromodification Reference Information

Article 32

Technical Note #58 from Watershed Protection Techniques. 2(1): 282-284

Methods for Estimating the Effective Impervious Area of Urban Watersheds

by Roger C. Sutherland, P.E.

One of the most difficult and important parameters that must be estimated for accurate hydrologic analyses is the effective impervious area (EIA) of a watershed or basin of interest. EIA is the portion of the total impervious area (TIA) within a basin that is directly connected to the drainage collection system. EIA includes street surfaces, paved driveways connecting to the street, sidewalks adjacent to curbed streets, rooftops which are hydraulically connected to the curb or storm sewer system, and parking lots.

EIA is usually reported as a percentage of total basin or subbasin area. In traditional urban runoff modeling or hydrologic analysis, the EIA for a given basin is usually less than the TIA. However, in highly urbanized basins, EIA values can approach and equal TIA values.

The EIA of a basin is an important parameter in the rainfall/runoff process because it directly affects the volume of runoff. Many hydrological models assume all the precipitation that falls on impervious areas becomes direct runoff. In actuality, the precipitation falling on impervious areas which are not hydraulically connected to the drainage collection system does not always result in direct runoff. Impervious area that does not contribute directly to runoff should be subtracted from the total impervious area to obtain the *effective* impervious area, in order to get a more accurate estimate of runoff volumes.

Determination of Effective Impervious Area

The methodology for determining EIA has been refined through three levels:

1. Direct measurement in the field

The direct measurement of EIA is a tedious exercise which is rarely undertaken since most consultants cannot afford its excessive labor cost. To actually measure the EIA of a basin, it is necessary to catalog and evaluate the effectiveness of the hydraulic connection between *each* of the impervious areas and the major collector systems. This extremely time consuming exercise is impractical for most drainage planning and design related activities.

2. Derivation from models run on gauging data

If a basin is gauged, the effective impervious area can be estimated by employing a rainfall-to-runoff model like HEC-1 or SWMM to calibrate the EIA parameter. This calibration is performed by fixing reasonable estimates of the precipitation loss components for the pervious portions of the basin and impervious areas, then adjusting the value of EIA to correlate computed and observed runoff volumes. The calibration process should be undertaken for several observed rainfall events, with the final estimate of EIA representing the weighted average of those values calibrated for each individual storm.

3. Empirical equations derived from whole-basin or subbasin parameters

Empirical equations can be developed to compute realistic values of EIA based on physical basin parameters that are easy to estimate. For example, the United States geological Survey (USGS) developed estimates of EIA for over 40 watersheds throughout the metropolitan areas of Portland and Salem, Oregon (Laenen, 1980 and 1983). Working with this database, the USGS also developed an empirical equation to estimate EIA as a function of total impervious area.

It should be noted that the modeling technique used by the USGS lumped all of the precipitation excess into a single optimized percentage of the basin area that was assumed to be contributing runoff. This optimized value was defined as the effective impervious area. Working with these optimized values, the USGS (Laenen, 1983) developed the following equation:

$$\mathrm{EIA} = 3.6 + 0.43\,(\mathrm{TIA}) \qquad (1)$$

Equation (1) has been found to work well for TIA values greater than 10% and less than 50% but provides unrealistic EIA values for TIA values outside of this range (i.e., more urbanized areas). In surface water management master planning, one commonly deals with *small subbasins* (i.e. 20 to 70 acres) in which the ultimate mapped impervious area can routinely exceed 50%, and may be as high as 90%.

Therefore, there is a need to develop a better relationship between TIA and EIA and several alternative equations based upon the USGS data have recently been developed to satisfy this need, known as the Sutherland Equations.

The general form of the equation to describe the relationship between TIA and EIA is as follows:

$$EIA = A\,(TIA)^B \qquad (2)$$

In Equation (2), A and B are a unique combination of numbers such that the following criteria are satisfied:

1. If TIA = 1 then EIA = 0%
2. If TIA = 100 then EIA = 100%

Based on the USGS calibrated values of EIA for all basins with TIA ≥ 4%, several empirical equations were developed to apply to various generalized conditions of subbasins which may be encountered in the drainage master planning process. The first equation presented below (Equation 3) provided the best fit for all of the TIA versus EIA data used in the analysis. The remaining equations were based primarily on engineering judgement and experience as related to the various subbasin conditions which affect EIA.

The **Sutherland EIA Equations** are as follows:

1. *Average basins* where the local drainage collector systems for the urban areas within the basin are predominantly storm sewered with curb and gutters, no dry wells or other drainage infiltration areas are known to exist, and the rooftops in the single family residential areas are not connected to the storm sewer or piped directly to the street curb.

$$EIA = 0.1\,(TIA)^{1.5},\ TIA \geq 1 \qquad (3)$$

2. *Highly connected basins* where everything in Condition 1 applies except the residential rooftops are predominantly connected to the streets or storm sewer system.

$$EIA = 0.4\,(TIA)^{1.2},\ TIA \geq 1 \qquad (4)$$

3. *Totally connected basins* where 100% of the urban area within the basin is storm-sewered, with all impervious surfaces appearing to be directly connected to the system.

$$EIA = TIA \qquad (5)$$

4. *Somewhat disconnected basins* where at least 50% of the urban areas within the basin are not storm sewered, but are served by grassy swales or roadside ditches, and the residential rooftops are not directly connected. Alternatively, Condition 1 may apply, but the basin is known to have a few dry wells or other infiltration areas.

$$EIA = 0.04\,(TIA)^{1.7},\ TIA \geq 1 \qquad (6)$$

5. *Extremely disconnected basins* where only a small percentage of the urban area within the basin is storm sewered, or a large portion of the basin area (i.e. 70 percent or more) drains to dry wells or other infiltration areas.

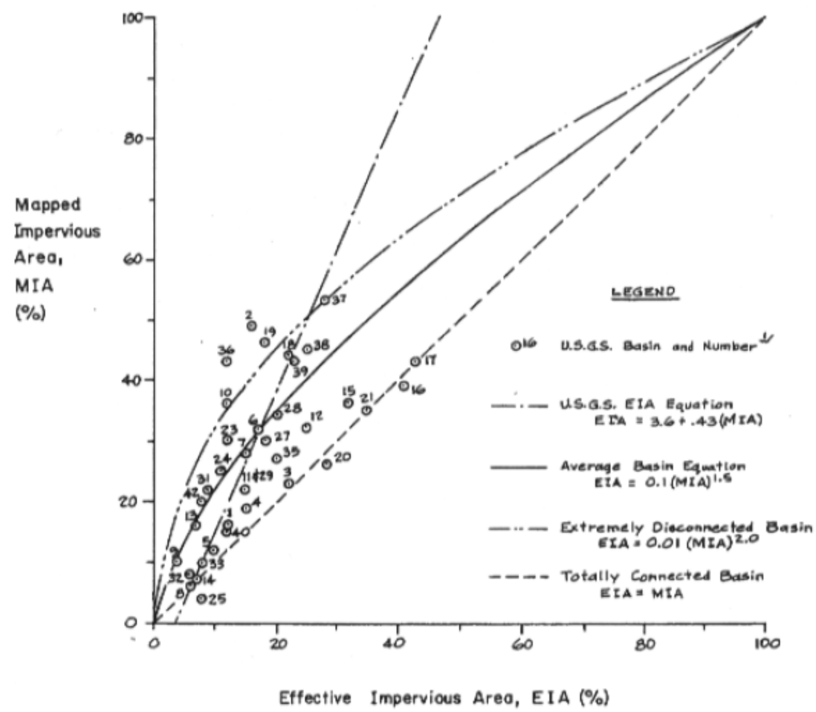
$$EIA = 0.01\,(TIA)^{2.0},\ TIA \geq 1 \qquad (7)$$

Figure 1 compares the Sutherland EIA Equations along with the original USGS Equation for the range of impervious data collected in Oregon. The variation in the 42 actual subbasin data presented in Figure 1 demonstrates the difficulty in accurately estimating the EIA of a drainage basin. It is imperative that the drainage planner or engineer performs some degree of on-site investigation of the basin to determine which EIA equation may apply to the given circumstance. The greatest strength of the Sutherland EIA Equations is their consistency in providing reasonable estimates of EIA over the entire range of TIA. Therefore, they can be used in the surface water management planning process to estimate the change in EIA which will occur as a basin becomes urbanized.

References

Laenen, A. 1980. *Storm Runoff as Related to Urbanization in the Portland, Oregon - Vancouver, Washington Area, U.S.G.S.* Water Resource Investigations Open File Report 80-689.

Laenen, A. 1983. *Storm Runoff as Related to Urbanization Based on Data Collected in Salem and Portland and Generalized for the Willamette Valley, Oregon, U.S.G.S.* Water Resources Investigations Open File Report 83-4143.



1/ EIA valves were based on a U.S.G.S. rainfall to runoff model study. Only points with MIA ≥ 4 were plotted (Laenen, 1980 and 1983).

Figure 1: Plot of Sutherland Equations and USGS Equation That Illustrates Relationships Between Total and Effective Impervious Area for a Range of Watersheds

C.2. Stream Rehabilitation Supporting Material

This appendix describes the methods to be used to assess receiving water geomorphic condition and develop appropriate rehabilitation designs that will mitigate for increased runoff from development projects.

C.2.1. Identify Domain of Analysis and Divide into GCUs

The Domain of Analysis shall be delineated per the following:

- Downstream limit will be to
  - exempt water body identified in the Watershed Management Area Analysis
- Upstream limit will be the closest of either
  - One grade control
  - Or a stable hard point (e.g. bedrock channel outcrop, section of riprap),
  - OR 20 x bankfull width
  - OR 200 m

Once the Domain of Analysis has been delineated, applicants will divide it into GCUs. These are reaches between significant tributaries or inflows, that have consistent slopes, widths, depths, channel materials, stream order, levels of geomorphic stability and geomorphic processes (e.g. stable, eroding or depositing throughout most of an individual reach). The applicant shall demonstrate that the reach or reaches delineated are internally consistent by providing supporting evidence such as long profiles, cross sections, photographs, LiDAR images. Where the channel condition varies within the Domain of Analysis, the applicant shall break the area into additional reaches.

C.2.2. Field Assessment (Part 1) Assess whether channel is stable or unstable

Channel stability shall be initially assessed for stability qualitatively, using the channel evolution model (CEM) developed by Hawley et al (2012) (see **Figure C.1**) for each GCU delineated in **Section C.2.1**.

- GCU is considered stable if it conforms with CEM Type 1 or CEM Type 5, or their equivalents in the Southern California Bifurcations, or the CEM for Braided Channels. Applicants who consider a GCU to be stable should provide supporting materials to support their assessment, including some or all of the following: channel cross sections, site photos, and historic aerial photos. GCUs that are identified to be of stable form shall require additional quantitative assessment (see **Section C.2.3**) to evaluate if the GCU can accommodate full built out condition.
- GCU is considered unstable if it determined to be CEM Type 2 or CEM Type 3 or CEM Type 4, or their equivalents in the Southern California Bifurcations, or the CEM for Braided Channels. GCUs that are identified to be of unstable forms shall require additional field assessment (see **Section C.2.4**) and rehabilitation (see **Section C.2.5**).

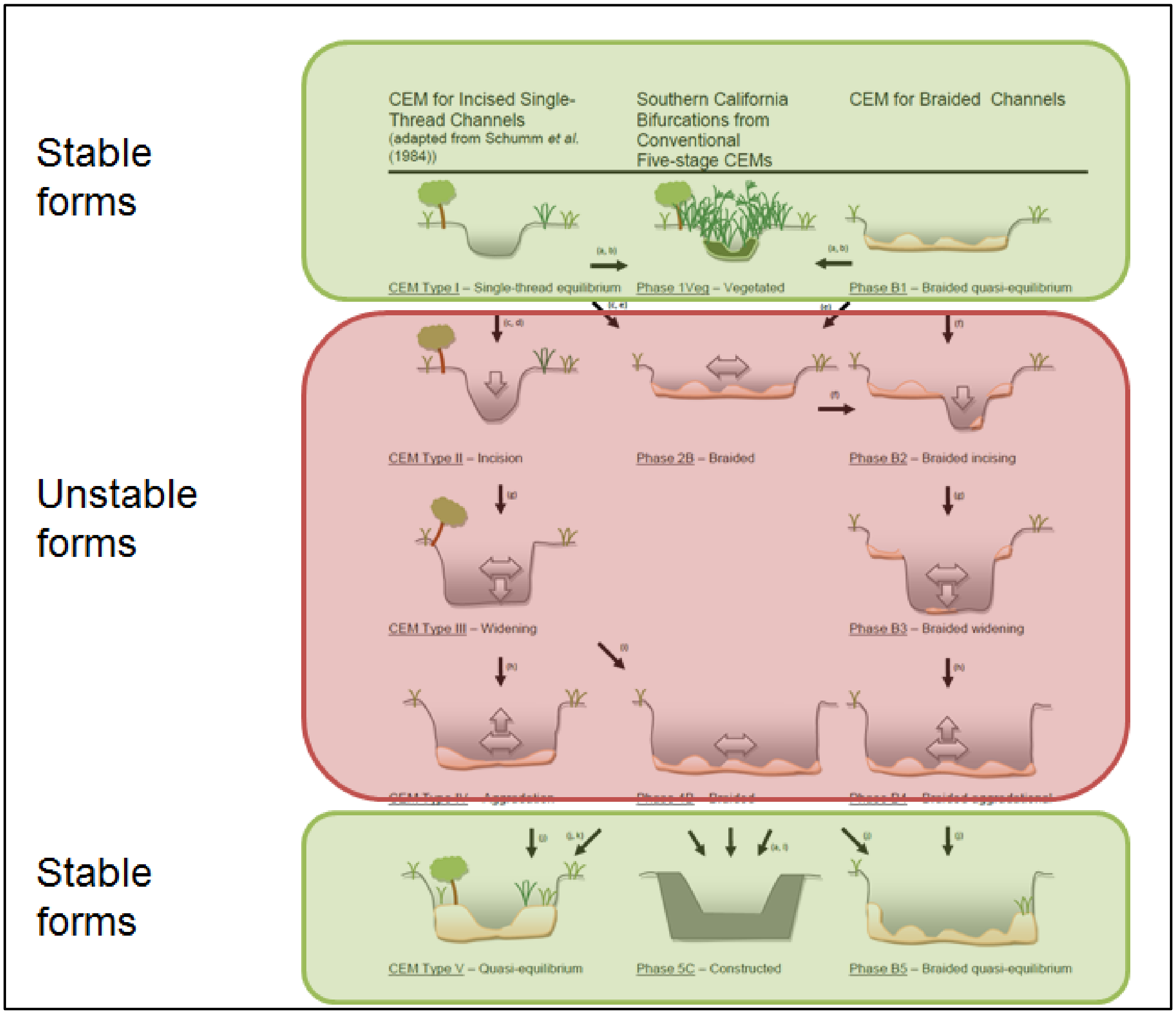


Figure C-1: Channel Evolution Models (CEMs) for Southern California (Hawley, Bledsoe, Stein and Haines, 2012)

C.2.3. Evaluation of Stable form GCUs

GCU that is identified to be a stable form in **<u>Section C.2.2</u>** shall be required to implement hydromodification flow control measures if it does not satisfy any one of the following two criteria:

- Erosion potential for the full built out condition compared to the existing condition is less than 1.20 when d50 >16 mm or is less than 1.05 when d50 < 16mm; **<u>OR</u>**
- Specific stream power for the full built out condition is less than the stable specific stream power dependent on the median channel sediment diameter estimated from **<u>Figure C-2</u>**.

<u>Erosion Potential (Ep)</u>: The ratio of post/pre-project transport capacity or work is termed Erosion Potential. Work is a dimensionless number that is a function of velocity and excess shear stress in the stream. For assessing stable form GCUs, the post-project condition shall be full built out condition and pre-project condition shall be existing condition, if the channel is currently stable. If the channel is not currently stable, then the pre-project baseline condition shall be a previous stable condition or the natural condition, if there is not known stable condition. In regards to Ep analysis SCCWRP Technical Report 667 "Hydromodification Assessment and Management in California" states:

> "The underlying premise of the erosion potential approach advances the concept of flow duration control by addressing in-stream processes related to sediment transport. An erosion potential calculation combines flow parameters with stream geometry to assess long term (decadal) changes in the sediment transport capacity. The cumulative distribution of shear stress, specific stream power and sediment transport capacity across the entire range of relevant flows can be calculated and expressed using an erosion potential metric, Ep (e.g., Bledsoe, 2002)".

The following provides the basis for the Ep criteria listed above:

- According to the Journal of Hydrology article titled Channel Enlargement in Semiarid Suburbanizing Watersheds: A Southern California Case Study (Hawley and Bledsoe, 2013):
    - "The threshold corresponding to the presence/absence of headcutting varied based on substrate type, and was roughly quantified as a sediment-transport ratio greater than ~1.20 in systems with a median grain size > 16mm, and [Ep] ~ 1.05 when d50 < 16 mm"

Specific Stream Power: Specific (i.e. unit) stream power is the rate at which the energy of flowing water is expended on the bed and banks of a channel (see **Equation C-1**).

Equation C-1: Calculation of Specific Stream Power

$$Specific\ Stream\ Power = \frac{Total\ Stream\ Power}{Channel\ Width} = \frac{\gamma QS}{w}$$

Where:

γ: Specific Weight of Water (9810 N/m^3)
Q: Flow Rate (dominant discharge in many cases, m^3/sec)
S: Slope of Channel
w: Channel Width

SCCWRP studies have found that locating channels on a plot of Specific Stream Power at Q10 (as calculated by Hawley et al's method optimized for Southern California watersheds – **Figure C-2**) versus median channel sediment diameter is a good predictor of channel stability. The Q10 equation from SCCWRP TR 606 is presented as **Equation C-2**

Equation C-2: Calculation of Q_{10} using Hawley's et al method

$$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$$

Where:

Q_{10cfs}: 10 year Flow Rate in cubic feet per second
A: Drainage Area in sq. miles
P: Mean Annual Precipitation in inches

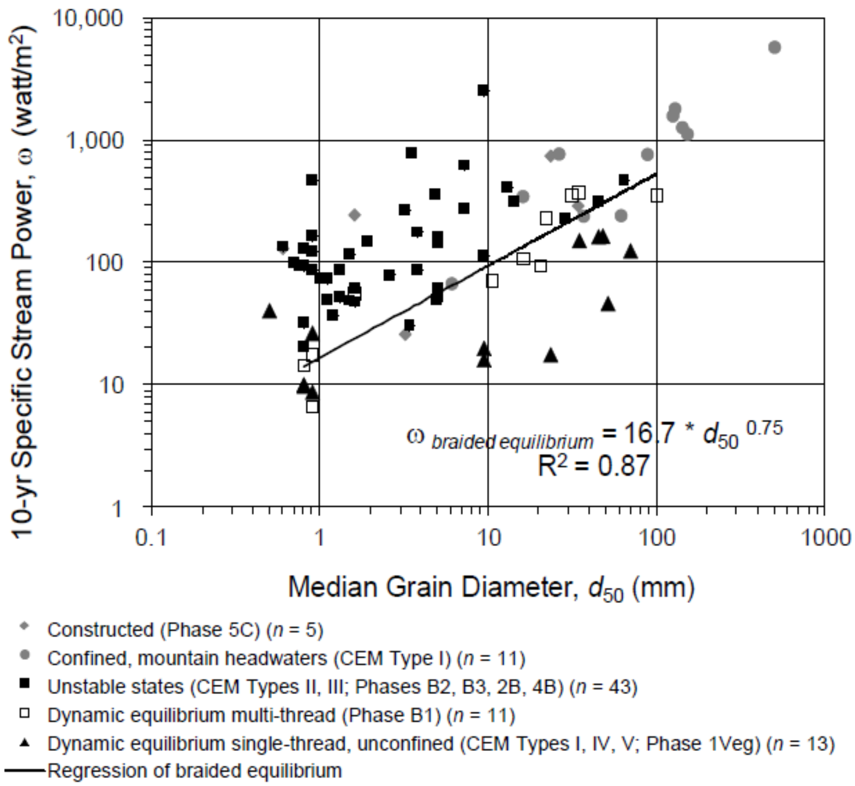


Figure C-2: Threshold of stream instability based on specific stream power and channel sediment diameter

Since the SCCWRP TR 606 Q_{10} (**Equation C-2**) does not explicitly consider watershed imperviousness, adjustment factors (AF) shown in **Figure C-3** were developed using the following **Equation C-3** for Q10 from SCCWRP TR 654 to account for imperviousness while estimating Q10

Equation C-3: Calculation of Q_{10} using equation from SCCWRP TR 654

$$Q_{10} = e^{3.61} * A^{0.865} * DD^{0.804} * P_{224}^{0.778} * IMP^{0.096}$$

Where:

Q_{10}: 10 year Flow Rate
A: Drainage Area in sq. miles
DD: Drainage Density
P_{224}: 2-Year 24-Hour Precipitation in inches
IMP: Watershed Imperviousness

Adjustment factors were developed by changing the watershed imperviousness in **Equation C-3** and keeping the remaining terms constant. Adjustment factor for imperviousness of 3.6% was set to 1; since it is the mean imperviousness of the dataset used to develop the stability curve in **Figure C-2**. Updated Q10 equation with adjustment factor is presented as **Equation C-4** below:

Equation C-4: Calculation of Q_{10} with Adjustment Factor for Watershed Imperviousness

$$Q_{10cfs} = AF * 18.2 * A^{0.87} * P^{0.77}$$

Where:

Q_{10cfs}: 10 year Flow Rate in cubic feet per second
AF: Adjustment Factor
A: Drainage Area in sq. miles
P: Mean Annual Precipitation in inches

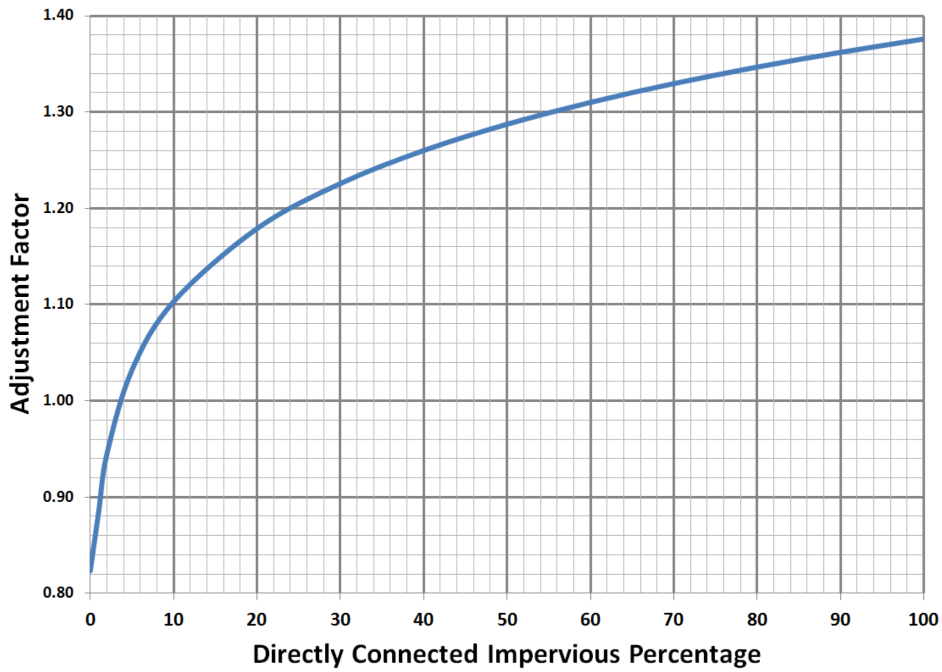


Figure C-3: Adjustment factor to account for imperviousness while estimating Q10

C.2.4. Desk and Field Assessment (Part 2)

The purpose of this section is to estimate how a channel is likely to respond to hydromodification. This informs the potential mitigation/rehabilitation approach used. The assessment is performed using the methods currently employed in the San Diego HMP for assessing stream stability (SCCWRP Technical Report 606). The assessment consists of a combination of a desk study and field study. These elements are combined to develop an assessment of vertical and lateral channel susceptibility based on watershed area, valley slope, mean annual rainfall, channel bank and bed material, bank height and angle and the presence or absence of grade controls. Examples of the field sheets are shown in **Figures C-4** and **C-5**, with a channel trajectory diagram in **Figure C-6**.

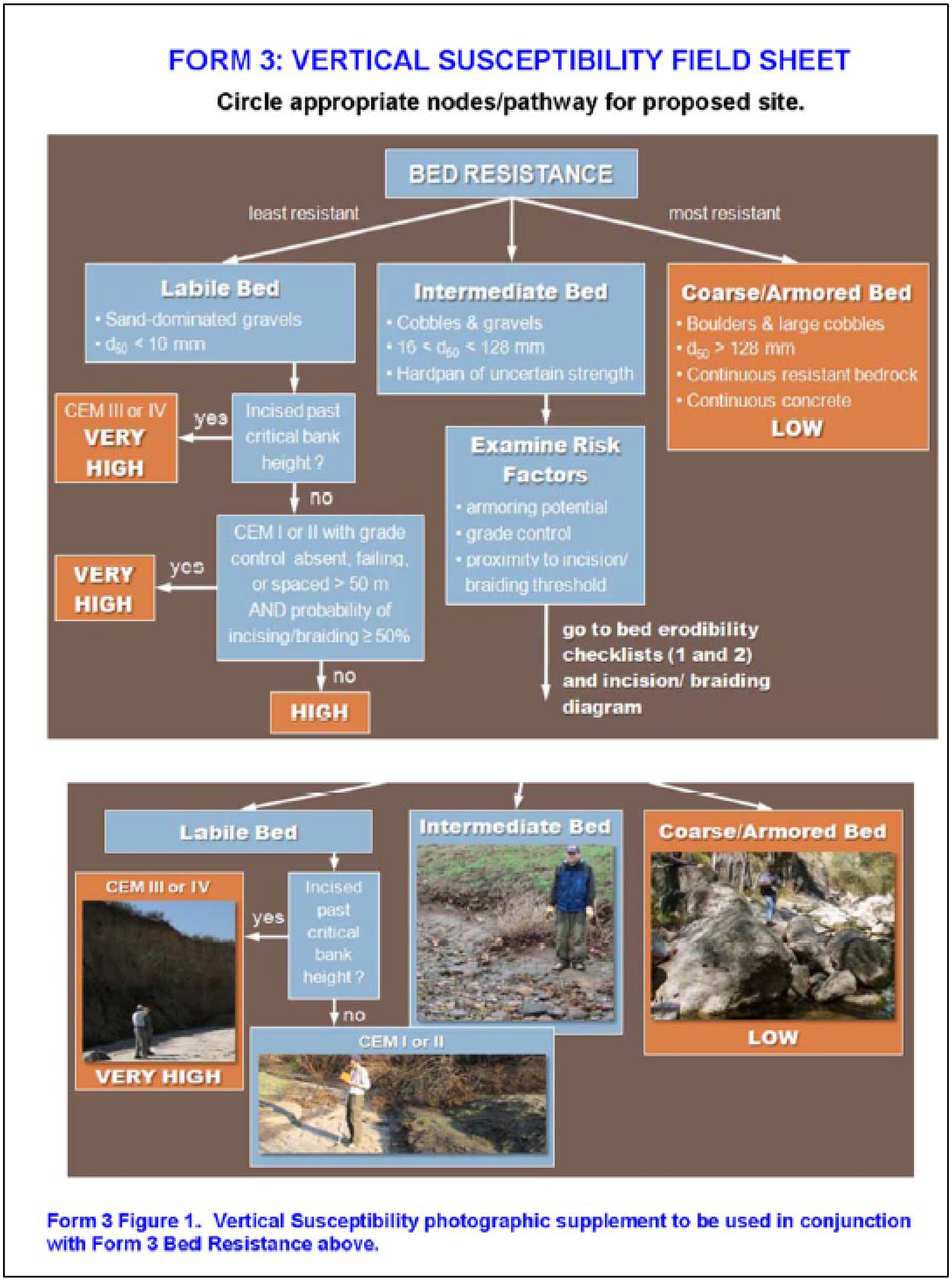


Figure C-4: Vertical channel susceptibility form (Source: SCCWRP TR 606)

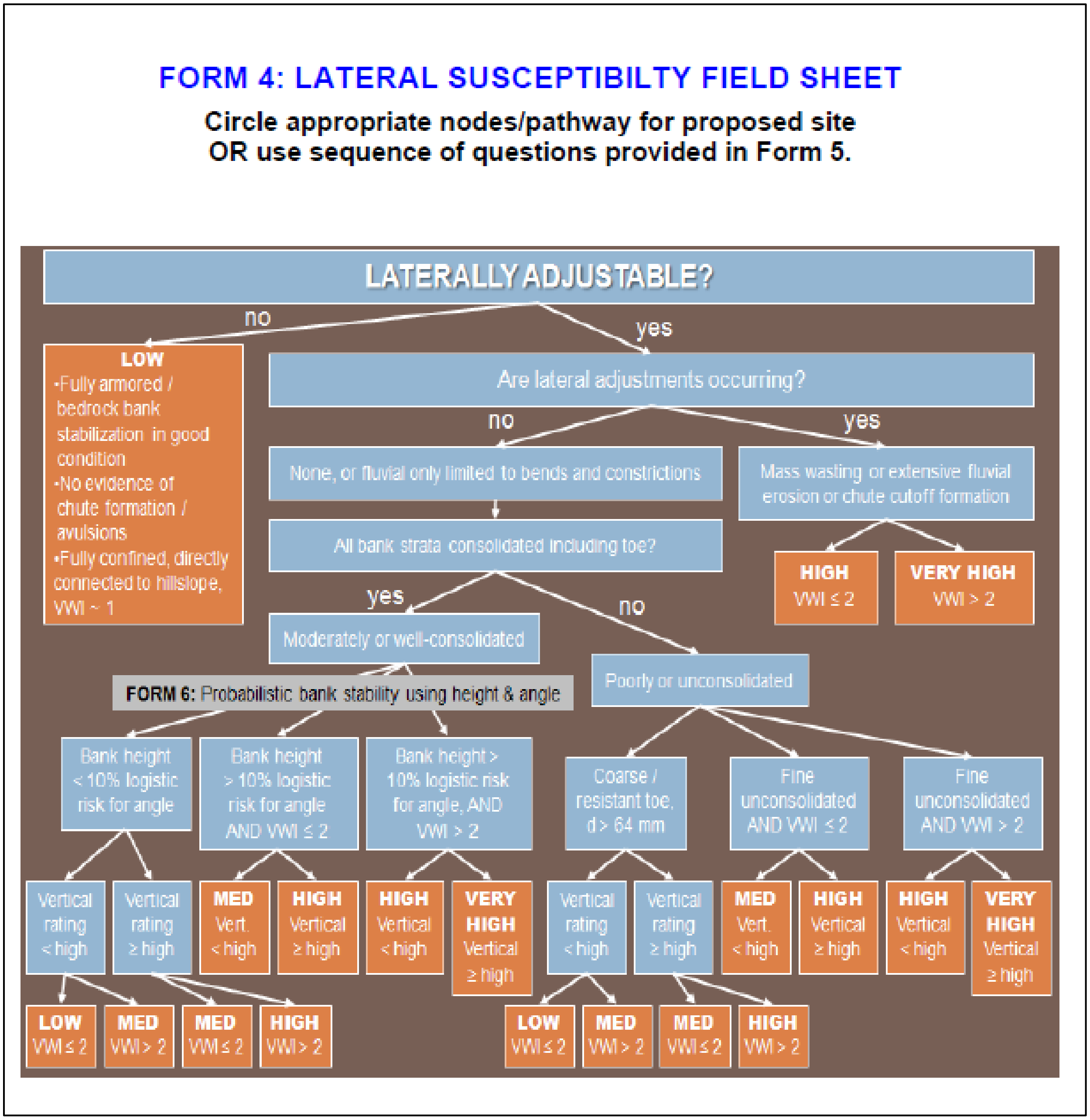


Figure C-5: Lateral channel susceptibility form (Source: SCCWRP TR 606)

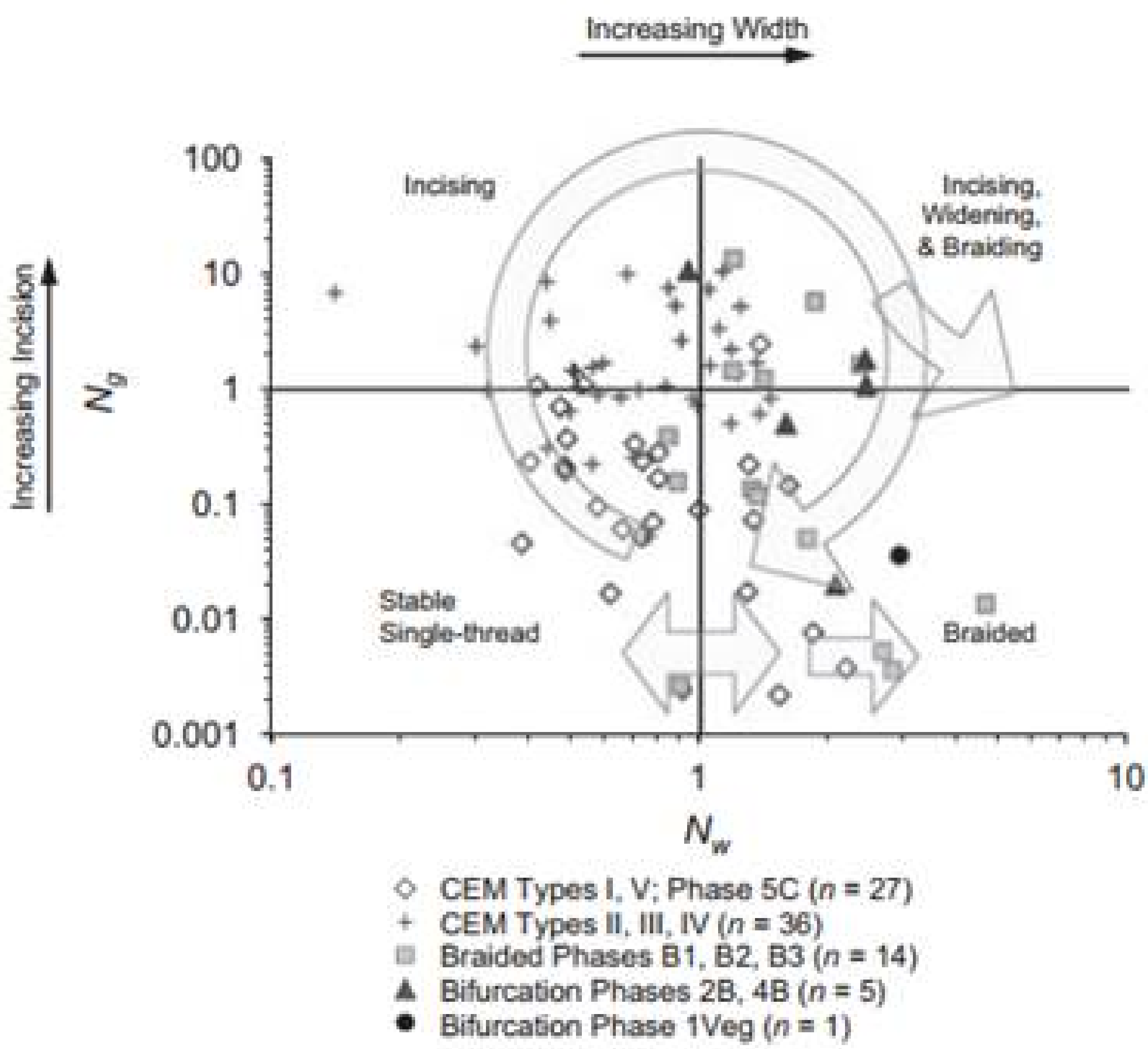


FIGURE 12. Dimensionless Stability Diagram (*sensu* Watson *et al.*, 1988) of Geotechnical Bank Stability (N_g) *vs.* Reference Width Ratio (N_w) of Southern California Sites with CEM Stages of Single-Thread/Incision and Braided Departures and Superimposed Block Arrows Indicating CEM Trajectories.

Figure C-6: Channel Stability Diagram (Source: SCCWRP TR 606)

The field and desk methods provide a vertical and lateral channel susceptibility classification, which is used to develop a remediation strategy in <u>**Section C.2-5**</u>.

C.2.5. Rehabilitate GCU by Widening or Flattening Channel Until it Meets the Performance Criteria

Each stream rehabilitation project is to some degree unique because of differences in geomorphic process, morphology and previous watershed history. For this reason this guidance does not provide a prescriptive 'cookery book' approach for rehabilitating streams, but instead provides guidelines and recommendations. Shields (1996) provides a helpful overview of the analytical steps involved in stream restoration and Shields et al. (1999) provides examples of approaches used to rehabilitate incised channels. Designers will need to provide geomorphic and engineering information to support their proposed project approach. It is recommended that multiple lines of technical evidence be used by designers to develop creek restoration plans based on the preponderance of evidence for design criteria such as channel width, depth, slope and planform. It is also important to understand that all stream rehabilitation projects must comply with relevant Federal, State and local regulations and permits. These will likely include obtaining permits from the RWQCB, USACE and California DF&W, and may involve additional permits or consultation with USDF&W and FEMA, as well as permits from the local jurisdiction. The proposed design must consider potential project constraints to proposed channel geometry and alignment and shall meet local drainage design guidelines for channel design.

For streams that have a high susceptibility to vertical erosion (classified as High or Very High for vertical susceptibility as shown on **Figure C-4** – **Section C.2.4** above) stream rehabilitation should address incision through the addition of grade control and will most likely involve flattening the channel slope to one that is in equilibrium with the built out condition water and sediment flux. For channels that are susceptible to lateral erosion (High or Very High rating in the form shown in **Figure C-5** – **Section C.2.4**) rehabilitation should involve widening the bankfull channel and/or creating a wider two stage channel with a floodplain bench above the bankfull channel (see **Figure C-7**). For this approach bankfull discharge is likely to be between Q2 and Q5 depending on the watershed and channel type.

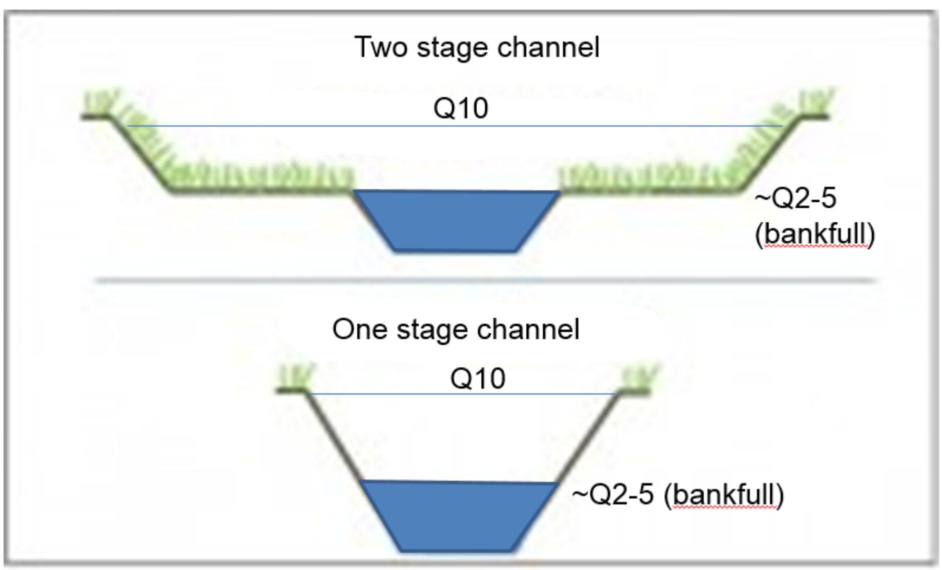


Figure C-7: Creating an inset floodplain bench or two stage channel to dissipate excess stream power during the Q10 event

The following guidelines are provided to support applicants in developing rehabilitation plans:

- Stream rehabilitation includes the modification of the channel gradient, cross section, or boundary materials to achieve stable conditions in the altered flow regime.

- Most channel designs address design issues in a hierarchical sequence that starts with channel planform (single thread or braided channel, sinuosity, amplitude and frequency of meanders or the braid belt); channel slope; width; depth.
- Channel planform should be informed by location in the watershed (headwaters to ocean), valley slope and confinement degree, geological controls, sediment supply and caliber, bank vegetation density and climate. This may be informed by historic studies, but applicants need to be aware that watershed changes such as urban development may result in a shift in stable channel planform. For example sediment reductions and perennial flows from landscaping may shift a braided stream into a single thread, slightly sinuous form.
- Channel slope should be in sediment transport equilibrium under the built out condition supply of water and sediment, as verified by sediment transport modeling or surveying of appropriate stable reference reaches.
- Channel width and depth may be estimated from regional hydraulic geometry curves, or using empirical methods such as the HEC RAS SAM model, or by use of appropriate stable reference reaches.
- The designer may consider implementation of planning measures such as buffers and restoration activities, revegetation, and use of less-impacting facilities at the point of discharge in lieu of implementation of storm water flow controls to accommodate additional runoff from the built out condition.

The following performance criteria must be analyzed to support the proposed design:

- Show that projected increases in runoff peaks and/or durations from the full built out condition would not accelerate degradation or erosion of rehabilitated receiving stream reaches.
- Implementation of stream rehabilitation mitigation measures would require a geomorphic analysis to show that the proposed changes to the stream channel cross sections, vegetation, discharge rates, velocities, and durations would not have adverse impact to the receiving channel's beneficial uses.
- Mitigation measures must be designed considering the ultimate condition 100-year flows (as well as lower return frequency events) to the rehabilitated channel segment.
- In addition to conforming with the above, it is required that the proposed channels be retested for channel susceptibility using **Section C.2.4** above, and that the proposed channel should have a Low susceptibility to vertical and lateral erosion.

Appendix D: Relevant WQE Mapping

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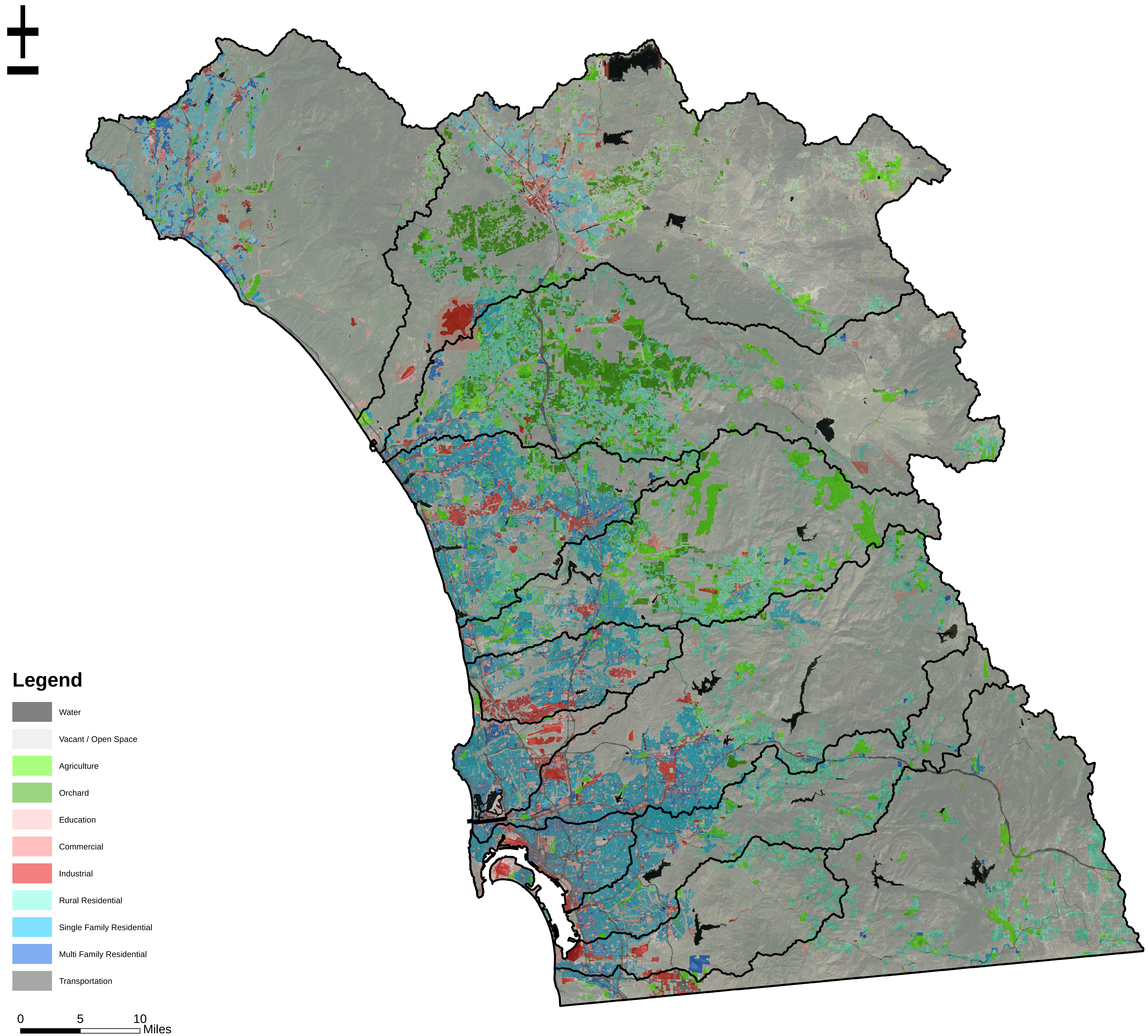
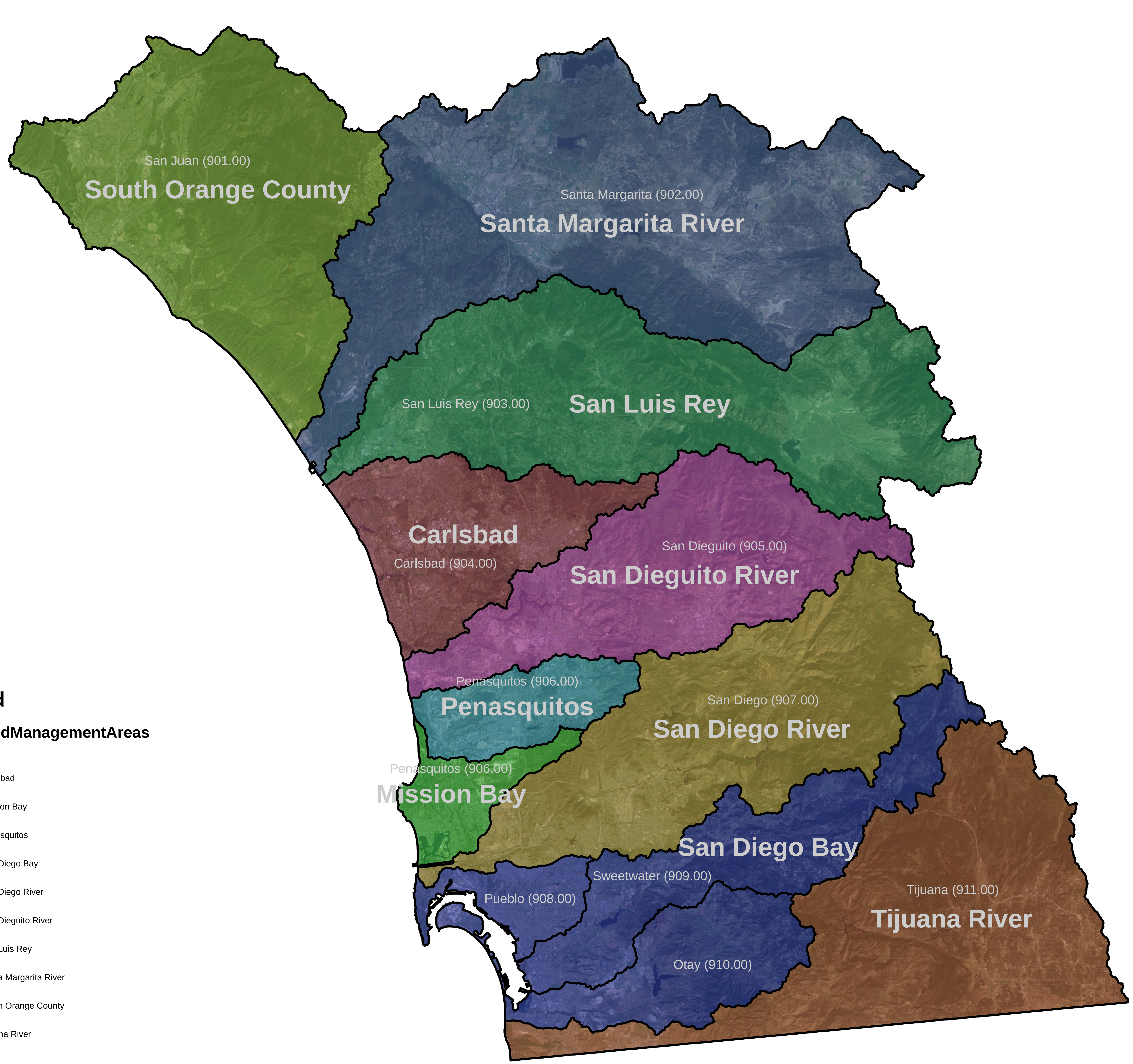


Note:
Higher resolution ArcGIS maps are available for download at www.projectcleanwater.org.

Exhibit 1:
EMC Land Use Mapping for Region 9



Legend

WatershedManagementAreas

Watershed

- Carlsbad
- Mission Bay
- Penasquitos
- San Diego Bay
- San Diego River
- San Dieguito River
- San Luis Rey
- Santa Margarita River
- South Orange County
- Tijuana River

0 5 10 Miles

Note:
Higher resolution ArcGIS maps are available for download at www.projectcleanwater.org.

Exhibit 2:
Watershed Management Areas & Hydrologic Units

Appendix E: Response to Comments

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Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Matt O'Malley	0	…we are somewhat disappointed that the natural BMPs (called "natural system management practices") section in the WQE Guidance is not fully fleshed out and remains a work in progress. We are concerned that such projects are not likely to get underway either through the WQIPs or Alternative Compliance program any time in the near future, if ever. We pledge to continue to work with all parties to find a way to ensure that these projects will be implemented on an abbreviated schedule.	Noted. We appreciate your efforts. We hope that project applicants will commit resources to assist as well and look forward to continuing to develop the natural system management practices as viable options for offsite alternative compliance.
Matt O'Malley	0	We wish to reiterate from earlier comments that under the current Alternative Compliance WQE scheme a program is being devised that fails to comply with the San Diego MS4 permit and with the Clean Water Act. In short, as proposed, what will result is a scheme to develop mitigation banks and currencies to trade not-in-kind pollutants across sub-watersheds and receiving waters. We cannot find an example of, nor the authority for, this type of cross-pollutant trading system in the MS4 context – or any other context - under existing law or regulations.	Noted. To approach this, we developed the land use factor, which uses the best available science we have to establish relative differences in degree of pollutant removals at different locations within a watershed based on tributary land uses being controlled with the alternative project, as compared to the PDP. This, in our opinion, provides a balance between simple to implement and protective with respect to pollutant loads and specific impairments of the receiving waters within the watershed. The land use factor has some conservatism built into how it is calculated and should result in greater overall benefit to water quality than the implementation of the retention or biofiltration standard at the PDP.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Matt O'Malley	0	While the permit recognizes that Alternative Compliance Projects (ACPs) must result in a "greater overall water quality benefit" to the watershed management area (WMA), the analysis of whether a credit system is appropriate does not end there. Equally important is the requirement in section E.3.c.(3)(e) that a credit system, "clearly exhibits that it will not allow discharges from Priority Development Projects to cause or contribute to a net impact over and above the impact caused by projects meeting the onsite structural BMP performance requirements."	Agree. This is how the equivalency relationships were established. The PDP still must implement flow through BMPs that meet medium or high pollutant removal efficacy for the priority pollutants associated with the watershed and PDP. Then, elsewhere in the watershed, the ACP will retain or biofilter the same amount of water if the tributary land uses are the same as the PDP and the tributary area is the same as the PDP, or will have to retain or biofilter more water than the PDP if the tributary land uses are different than the land use of the PDP to account for the relative differences in pollutant loads. This will, in aggregate, result in an overall greater water quality benefit than implementation of the new and re-development standards without alternative compliance.
Matt O'Malley	0	With no apparent link in the WQE Guidance document of specific receiving water impairments to either the project's expected pollutants and to the pollutants expected to be addressed by the ACP, projects that would qualify for alternative compliance credit would not necessarily result in a "greater overall water quality benefit" for the Watershed Management Area. Further, projects that might result in a greater overall water quality benefit in one sub-watershed (eg. within the ACP sub-watershed) but that fail to account for the addition of pollutants and potential deterioration of water quality in another (eg. the Project sub-watershed) could also result. Without actually accounting for pollutant loads and receiving water impairments by project and by ACP within a particular location, the WQE as proposed cannot demonstrate that discharges from Priority Development Projects (PDPs) will not cause or contribute to a net impact over and above the impact caused by projects implementing onsite BMPs.	The pollutants of concern for each watershed are the basis for determining water quality equivalency. The calculation of the land use factor requires 1) selection of pollutants for which the receiving water is impaired, and 2) selection of the lowest land use factor associated with each pollutant of impairment based on its relative difference in load between the ACP and PDP. Thus, pollutants generated by the PDP will be treated to the same degree in the ACP plus other pollutants will be treated to a greater degree by the ACP. This will result in a greater mass load reduction through ACPs than would otherwise occur with implementation of the new and re-development program without the option of alternative compliance.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	**Comment Response**
Matt O'Malley	0	Coastkeeper realizes that a program that meets the demands of both the permit and the Clean Water Act would restrict the types of projects eligible for Alternative Compliance consideration. However, unless the alternative compliance program considers actual pollutants expected from actual PDPs, considers those pollutants addressed by ACPs, and considers actual receiving water impairments and the impacts of those pollutants and projects on those impairments, the program as a whole would engage in trading of not-in-kind pollutants across sub-watersheds and receiving waters. Our comments of September and October 2014 (attached) speak in detail regarding the legal and practical issues with that approach, and are submitted here for reference.	We appreciate Coastkeeper's comments. Based on your previous comments from September and October of 2014, we revised our formulas to include the land use factor that includes specific watershed pollutants. As discussed above, the land use factor, which uses the best available science we have to establish relative differences in degree of pollutant removals at different locations within a watershed based on tributary land uses being controlled with the alternative project, as compared to the PDP. This, in our opinion, provides a balance between simple to implement and protective with respect to pollutant loads and specific impairments of the receiving waters within the watershed. Also, the land use factor to be used is based on the pollutant of concern that the ACP is treating the least, which increases the size of the ACP to be "equivalent" to retention or biofiltration on the PDP. This results in treating the remaining pollutants to a greater degree than would retention or biofiltration on the PDP, which will result in a greater overall benefit to water quality.
Matt O'Malley	0	Recommendation: Utilize "pollutant loads" or "loads not generated" as currency for Pollution Control and require on-site specific assessments of types of pollutants and land use, as well as off-site specific assessments of BMP effectiveness to remove or treat pollutants. This will allow for mitigation of impacts "caused by" lack of onsite BMPs as required in the permit.	Comment noted. The pollutants are considered as part of the land use factor. This was added following the Coastkeeper comments from September and October of 2014. Following receipt of those comments our team addressed options for including the specific pollutants. The current calculation of the land use factor and use of the lower land use factor in the calculation was developed as the way to address specific pollutants loads in the watersheds while still keeping the guidance simple enough to implement.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Matt O'Malley	0	Recommendation: Consider impairments, listings, or conditions specific to receiving waters when determining whether "greatest overall water quality benefits" are achieved, and to demonstrate that the, "credit system clearly demonstrates it will not allow" PDP discharges to contribute to net impacts over and above impacts caused if onsite BMPs were implemented under the permit.	The pollutants of concern for each watershed are the basis for determining the land use factor element water quality equivalency. Pollutants of concern are impairments aligned with existing land-use based runoff concentration data. Land-used based runoff concentration data does not exist for each pollutant for which a 303(d) listing exists, so the land-use based pollutant is aligned with the 303(d) pollutant based on chemical fate and transport characteristics of the pollutants.
Matt O'Malley	0	Recommendation: If "volume" is retained as currency for hydromodification, require site specific "conditions" assessments so actual impacts "caused by" lack of onsite BMPs are "clearly exhibited".	This is no longer volume. It is now based on directly connected impervious surface (DCIA), because the land feature that increases peak flows and volumes of water tends to be impervious area. The connectedness of that impervious area affects peak flows substantially. One major goal of the HMP program is to mitigate for the development of DCIA that has caused stream instability. DCIA represents a currency that can be readily tracked and verified. Methods for correlating runoff flow-duration to the amount of DCIA that would create the increase in flow-duration have been developed and adopted within the region and are ready to apply for the purpose of ACP evaluation.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Matt O'Malley	0	Recommendation: Begin any resulting WQE and Alternative Compliance program with a pilot project that includes associated monitoring to show that pollutant control and hydromodification mitigation measures are effective, address impacts "caused by" lack of onsite BMPs, and that the credit system established "clearly exhibits it will not allow discharges from PDPs to cause or contribute to a net impact over and above the impact caused by projects meeting the onsite requirements." Recommendation: Require monitoring to show the resulting credit system "clearly exhibits it will not allow discharges from PDPs to cause or contribute to a net impact over and above the impact caused by projects meeting the onsite requirements."	We appreciate the recommendation, but a pilot project is beyond what is required by the permit. It is important to note that retention and biofiltration on PDPs do not require monitoring or pilot testing before implementing the requirement as a presumptively effective BMP. The standards being adhered to for ACPs follow the BMPDM so that there should be no difference in the actual effectiveness of ACPs as compared to retention or biofiltration on PDPs. The equivalency factors take into account differences in pollutant loads from tributary land uses to ACPs as compared to PDPs and take into account differences in BMP efficacy of ACPs would the ACP capture and treat less than the 85th percentile storm from the subcatchment tributary to it based on the same load curves established in the BMPDM for sizing of retention and biofiltration on PDPs. To verify the entire new and re-development program, studies of BMP effectiveness would be helpful, indeed. However, isolating ACPs to study independently would not be useful to help understand the overall effectiveness of implementing BMPs as part of new and re-development, whether the BMPs are on PDPs or elsewhere in the watershed - because there is no data to for implementation of BMPs on PDPs against which to compare ACPs against.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Matt O'Malley	0	Recommendation: Require any resulting program of credits or mitigation banks to be administered by a neutral third-party entity, with in-perpetuity endowments to ensure operation and maintenance long-term and proper record keeping.	This is beyond the scope of the Water Quality Equivalency guidance. Credits and mitigation banking will be addressed in the future. The purpose of this document is to establish the basis for equivalency so ACPs can be sized and it can determine how much PDP retention or biofiltration can be offset by an ACP. The actual governance program for implementing ACPs is to be developed at the discretion of each jurisdiction. At the time of development of the governance program, participation by stakeholders is strongly encouraged to help guide the planning effort.
Chris Crompton	0	The title of the document should include reference to municipal stormwater permits or post construction requirements since the fundamental reason for the guidance is to assist Copermittees with ACP conditioning and approval. An appropriate addition to the title might include the following: Regional Water Quality Control Board, San Diego; MS4 Permit: Order No. R9-2013-0001, NPDES No. CAS0109266.	Document text revised accordingly.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	**Comment Response**
Chris Crompton	0	The WQE calculation methods depend on several factors by default. Order No. R9-2013-0001 requires development projects to implement infiltration, capture and use BMPs as a first priority. If retention of the design capture volume (DCV} onsite with those specified BMPs is not possible, any runoff from the unretained portion of the DCV must use biofiltration BMPs - specifically sized to treat 150% of the DCV (1097-1111 and elsewhere}, or flow-thru BMPs. This guidance should suggest a need for more flexibility in sizing biofiltration BMPs, since each case is unique. If receiving water quality standards can be met for a site, with or without an ACP, using a biofiltration sizing metric less than 1.5 times the DCV, a Permittee should be able to approve such a project.	Noted. As noted in Appendix E: Response to TAC/SAG Comments on Previous Draft #3 of WQE Guidance Document, "The intent of the Water Quality Equivalency Guidance Document is to demonstrate that implementation of an Alternative Compliance Project provides a greater overall water quality benefit than fully satisfying onsite water quality requirements. Therefore, when considering the pollutant removal efficiency for biofiltration elements, it is fundamentally important that the water quality equivalency guidance consistently apply such efficiencies to both PDPs and ACPs. The biofiltration pollutant removal efficiency of 66.6% has been established for use in the water quality equivalency guidance document based on biofiltration sizing criteria set forth in the Permit which states that biofiltration elements must be sized to biofilter 1.5 times the DCV. The Permit does not directly state that biofiltration elements provide an efficiency of 66.6% and the water quality equivalency guidance does not provide scientific data to support such a value; rather, this value is used solely within the context of water quality equivalency guidance to demonstrate that biofiltration of 1.5 times the DCV at 66.6% efficiency results in treatment that is equivalent to what would have been provided onsite by a PDP (1.50 x 0.666 = 1.00)."

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Chris Crompton	0	The so-called "AB1600 requirements" place constraints on the fee(s) which can be imposed on alternative compliance programs and projects, and it is not clear how the development impact fees might affect the development and operation of in-lieu or water quality credit systems. The guidance should describe these potential constraints so project proponents and Permittees can plan ahead to understand and address them as appropriate before a project begins.	This is beyond the scope of the Water Quality Equivalency guidance. The purpose of this document is to establish the basis for equivalency so ACPs can be sized and it can determine how much PDP retention or biofiltration can be offset by an ACP. The actual governance program for implementing ACPs is to be developed at the discretion of each jurisdiction, which would include how fees are set for administering the program. Jurisdictions may provide their own AB1600 guidance documents. At the time of development of the governance program, participation by stakeholders is strongly encouraged to help guide the planning effort.
Chris Crompton	0	The entire document needs a thorough review to reduce redundancies, ensure consistent terms are used throughout, and verify that the spreadsheet calculators are correct.	Noted, additional review performed.
Chris Crompton	0	The sections that define acronyms, abbreviations, and selected terms are very helpful, but should be carefully reviewed to ensure they are correct and consistent internally and as used in Order No. R9-2013-0001. Definitions that, in particular, need to be reviewed for consistency include: Water Quality Improvement Plans (WQIPs), Watershed Management Area Analyses (WMAA), and the updated BMP Design Manual (BMPDM).	Noted, additional review performed.
Chris Crompton	0	Several definitions need clarification as described below. The term "water quality benefit(s)" is used several places in the document, but is not formally defined, even though it is fundamental to the guidance. It is not clear whether "water quality benefit" includes benefits from pollutant control BMPs as well as hydromodification control BMPs. The text should also clearly differentiate "Alternative Compliance Program" from "Alternative Compliance	Additional clarification on the referenced definitions has been incorporated into the report text.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
		Project (ACP)." These terms should be more formally defined and the abbreviation "ACP" applied consistently throughout the text. It is also not clear whether "direct" in the phrase " ... 'direct' management of stormwater pollutant control. .. " (line 329) is synonymous with "onsite" or has a different meaning.	
Chris Crompton	0	There are conservative assumptions throughout the document; many of the formulae in this guidance rely on values provided from literature, land use mapping, and best professional judgement. For example, biotreatment BMPs must be sized 1.5 times larger than the DCV, and the efficacy of pollutant removal BMPs is reduced by one-third (0.66 times the literature established removal efficiency factor) applied to tabulated values of removal efficiency. The Guidance should include the potential for flexibility in these assumptions if supported by the overall project design.	Noted. As noted in Appendix E: Response to TAC/SAG Comments on Previous Draft #3 of WQE Guidance Document, "The intent of the Water Quality Equivalency Guidance Document is to demonstrate that implementation of an Alternative Compliance Project provides a greater overall water quality benefit than fully satisfying onsite water quality requirements. Therefore, when considering the pollutant removal efficiency for biofiltration elements, it is fundamentally important that the water quality equivalency guidance consistently apply such efficiencies to both PDPs and ACPs. The biofiltration pollutant removal efficiency of 66.6% has been established for use in the water quality equivalency guidance document based on biofiltration sizing criteria set forth in the Permit which states that biofiltration elements must be sized to biofilter 1.5 times the DCV. The Permit does not directly state that biofiltration elements provide an efficiency of 66.6% and the water quality equivalency guidance does not provide scientific data to support such a value; rather, this value is used solely within the context of water quality equivalency guidance to demonstrate that biofiltration of 1.5 times the DCV at 66.6% efficiency results in treatment that is equivalent to what would have been provided onsite by a PDP (1.50 x 0.666 = 1.00)."

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Chris Crompton	0	The document should provide rationale for treating 1.5 times the DCV when using biofiltration.	As noted in Appendix E: Response to TAC/SAG Comments on Previous Draft #3 of WQE Guidance Document, "R9-2013-001 Fact Sheets indicate that the 1.5 multiplier for biofiltration is based findings from the Ventura County Technical Guidance Manual which correlated reductions in annual runoff volumes provided by retention and biofiltration." Note the specific approach for estimating biofiltration effectiveness is presented in Appendix D of the Ventura County Guidance Manual.
Chris Crompton	0	The document should define "greater overall water quality benefit." The guidance compares impacts to benefits for pollutants and hydromodification control; if benefit is greater, then overall water quality benefits are deemed greater. This seems overly simplistic. In some cases impacts versus benefits may be too close to call. It would be helpful to include a requirement that benefits must be found to be greater than impacts by a "statistically significant" margin. The document should define Applicant-Implemented and Independent ACPs to include the respective application of the performance standard	The land use and BMP efficacy factors are to provide the basis for equivalency that provides a "greater overall benefit to water quality". An attempt was made to create guidance simple enough to be implemented while still protective with respect to pollutant loads and specific impairments of the receiving waters within the watershed. The use of the lowest land use factor is anticipated to increase the benefits associated with the other pollutants and this margin between the pollutant associated with the lowest land use factor and the other pollutants will vary from project to project.
Chris Crompton	0	PDPs and ACPs may call for BMPs that have medium or high effectiveness; however, these effectiveness values are not defined.	BMPs per the County's BMP Design Manual. The WQE has elected to defer to the BMPDM for establishing the acceptability and pollutant removal efficiency to associate with flow through or proprietary BMPs when evaluated for application as ACPs. Each jurisdiction will have discretion for how to accept, or not, flow through or proprietary BMPs under the guidelines established in the BMPDM.
Matt Yeager	217	should be mu; μ	Document text updated accordingly.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Matt Yeager	223	for copper and zinc abbreviations, should they be TCu, and TZn (as is TPb)?	Document text updated accordingly.
Matt Yeager	232	should this be ...A ***BMP*** project implemented?	Comment noted, no revisions made.
Matt Yeager	233	...area and ***to*** offset ***expected*** water quality and ***hydromodification*** impacts associated with one or more Priority...	Document text updated accordingly.
Matt Yeager	233	"Water quality impacts;"should-does this include hydromod? I think it should be called out as such, or perhaps add a definition of impacts that that includes HM impacts.	Document text updated accordingly.
Matt Yeager	236	rewrite text; seems that the salient point is that the ACP BMP is located within the project boundaries…	Comment noted, no revisions made.
Matt Yeager	236	Sentence should begin "Alternative Compliance Projects that…" Strike "~~Applicant Implemented~~"…	Document text updated accordingly.
Matt Yeager	241	Should this include reference specifically to hyromod mitigation processes?	Comment noted, no revisions made.
Matt Yeager	241	suggest "specific" rather than "amended"	Comment noted, no revisions made.
Matt Yeager	242	replace "Treatment is through" with "Pollutant Removal processes include," "filtration…"	Comment noted. Current definition is taken from MS4 Permit language so no changes will be made.
Matt Yeager	245	~~The dominant forces typically controlling channel form are~~: "Channel form is primarily controlled by…"	Document text updated accordingly.
Matt Yeager	246	~~most basic function is~~: primary ***geomorphic processes are*** to convey water and sediment.	Document text updated accordingly.
Matt Yeager	256	~~may~~	Comment noted, no revisions made.
Matt	261	~~augmented~~: determined	Comment noted, no revisions made.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Yeager			
Matt Yeager	264	~~the~~: any	Comment noted, no revisions made.
Matt Yeager	276	~~that are~~	Document text updated accordingly.
Matt Yeager	280	Changes in landforms (i.e., channel forms) and the processes that shape Changes in landforms (i.e., channel forms) and the processes that shape them~~ that are often caused by land use change~~.	Document text updated accordingly.
Matt Yeager	283	~~biologic~~: ecological	Document text updated accordingly.
Matt Yeager	284	Such impacts may ~~be associated with~~ impair~~ment~~ ~~of~~ beneficial uses and degrade~~ation of~~ stream conditions.	Document text updated accordingly.
Matt Yeager	296	~~Alternative Compliance Projects~~: ACPs	Document text updated accordingly.
Matt Yeager	298	*Benefits and impacts for stormwater pollutant control and hydromodification flow control must be considered individually.* **This concept should be incorporated globally into all relevant definitions.**	Comment noted, no revisions made.
Matt Yeager	308	An ~~Alternative Compliance Project~~ **ACP** ~~that is~~ owned or constructed by a party other than the PDP applicant. Independent ACPs may only be used to mitigate for PDPs within a RWQCB-approved credit system.	Comment noted, no revisions made.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Matt Yeager	308	Is it possible for a single owner or construction company to implement a ACP for a PDP? Would an in-lieu fee program be required for these ACPs, or could they be accommodated by the WQMP, or post-construction requirements approved by a co-permittee?	This is beyond the scope of the Water Quality Equivalency guidance. The purpose of this document is to establish the basis for equivalency so ACPs can be sized and it can determine how much PDP retention or biofiltration can be offset by an ACP. The actual governance program for implementing ACPs is to be developed at the discretion of each jurisdiction. At the time of development of the governance program, participation by stakeholders is strongly encouraged to help guide the planning effort.
Matt Yeager	311	An optional program that may be implemented by **individual** Copermittees ~~individually~~ or with other entities to allow a project proponent to fund or partially fund one or more ~~Alternative Compliance Projects~~ **ACPs; accepted ACPs constitute full compliance** ~~in-lieu of fully complying~~ with ~~the~~ on-site pollutant reduction **and**/or hydromodification management requirements of Order No. R9-2013-0001.	Comment noted, no revisions made.
Matt Yeager	319	A Natural System Management Practice **(NSMP)** that permanently preserves undeveloped land in its current state.	Document text updated accordingly.
Matt Yeager	334	An optional program that may be implemented by Copermittees to allow for offsite ~~Alternative Compliance Projects~~ **ACPs** to offset stormwater pollutant control and hydromodification impacts that are not fully addressed at ~~Priority Development Project~~ **PDP** sites.	Document text updated accordingly.
Matt Yeager	338	Insert **NSMP**, and strike ~~Natural System Management Practice~~ where appropriate (throughout)	Document text updated accordingly.
Matt Yeager	372	~~…whether a stream is or is not stable or it can focus on the degree to which it is unstable.~~	Document text updated accordingly.
Chris Crompton	414	An executive summary is typically prepared as a condensed version of the larger paper or report-usually an executive	Document text updated accordingly.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
		summary can stand alone and provide useful information. The current executive summary does not do this.	
Chris Crompton	414	For this draft, the first paragraph of the executive summary is incomplete and non-specific. The document should be edited to improve clarity and provide more specificity. For example, it could state that "the Permit was adopted by the Regional Water Quality Control Board, San Diego Region, and only applies to specific areas in San Diego, Orange, and Riverside Counties."	Document text updated accordingly.
Chris Crompton	414	The text needs definitions or at least context for new terms such as "Offsite Alternative Compliance," how development/redevelopment projects play a "pivotal role" in improving watershed health, and the timeframe for transforming water quality in urban areas.	Alternative Compliance Project to be added to the Definitions and included in Introduction text. Executive Summary otherwise revised. This will be clarified to provide context for the role the new and re-development program plays in creating a benefit to water quality and how this alternative compliance option equivalency method is being constructed to create a greater overall benefit to water quality when compared to the new and re-development program implemented per the standard specified in the permit.
Chris Crompton	414	The basic roles of the WQIPs, the WMAAs, and the BMPDM should be at least minimally described.	Comment noted. These are discussed in the Introduction to show relationship to the permit and WQE.
Chris Crompton	414	It is advisable to generally avoid terms such as "more or less stringent" and "not in full compliance," as they refer to stringency and compliance somewhat out of context-when in fact Alternative Compliance approaches must provide greater overall water quality for the areas in question. These terms are used this way in the MS4 Permit, but, if done correctly, implementing or investing in an approved ACP constitutes Maximum Extent Practicable (MEP) and equivalent compliance.	Comment noted. Executive Summary rewritten.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Chris Crompton	414	The last paragraphs on Page XV (lines 428 - 447) are confusing with regard to credit systems and in-lieu programs, and whether they relate to owner-implemented and applicant implemented BMPs. The Executive Summary should clearly state that this guidance brings the WQE metrics and methodologies to the Copermittees, project proponents, and other watershed stakeholders. Developers of Priority Development Projects (PDPs) and Copermittees can use these metrics and methodologies as a common frame of reference to design and evaluate designs for development projects.	A more comprehensive executive summary will be prepared for RWQCB submittal. The section mentioned by the commenter has been generally replaced with text regarding what is provided by the guidance and how it can be used.
Matt Yeager	418	~~At the core of~~ ~~offsite alternative compliance~~ ~~is an~~ ~~understanding that~~ **Effective conditioning of** development… play**s**…	Comment noted. Executive Summary rewritten.
Joanna Ogintz	423	Final authority – Provide greater clarity on the role the co-permittees play in the implementation of off-site, alternative compliance projects. Will they follow this Water Quality Equivalency Guidance Document? Will they implement their own programs? What is the default mechanism for approval – the co-permittee's approval process or this WQE Document? Please define who is ultimately responsible for making the decisions about what BMPs are allowed.	This is beyond the scope of the Water Quality Equivalency guidance. The purpose of this document is to establish the basis for equivalency so ACPs can be sized and it can determine how much PDP retention or biofiltration can be offset by an ACP. The actual governance program for implementing ACPs is to be developed at the discretion of each jurisdiction. At the time of development of the governance program, participation by stakeholders is strongly encouraged to help guide the planning effort.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Chris Crompton	678	There is also confusion as to whether the credit/in-lieu system(s) must be developed prior to approval of an independent ACP. These systems will be challenging to develop and implement. It seems that there is a 4-year default timeline- ACPs must be started within 4 years of the issuance of a building occupancy permit. The guidance document should include information on how temporal issues between PDP development and ACP implementation will be resolved, and whether a PDP can move forward prior to ACP completion. For example, if the ACP is identified, funded, and designed but still going through final environmental permitting.	This is beyond the scope of the Water Quality Equivalency guidance. The purpose of this document is to establish the basis for equivalency so ACPs can be sized and it can determine how much PDP retention or biofiltration can be offset by an ACP. The actual governance program for implementing ACPs is to be developed at the discretion of each jurisdiction. At the time of development of the governance program, participation by stakeholders is strongly encouraged to help guide the planning effort.
Chris Crompton	700	The document contains inconsistencies in describing the outcome of stream rehabilitation. Stream rehabilitation is described as restoration to predevelopment conditions on page 10 (lines 699-701, Natural System Management Practices); however, page 46 reads "Stream Rehabilitation restores a stream to a natural, stabilized condition that can accommodate both legacy and future hydromodification impacts. Stream Rehabilitation may provide quantifiable hydromodification flow control benefits through permanent stabilization of streams. Implementation of the second approach to stream rehabilitation projects could potentially change these stream reaches from a susceptible or unstable condition to a stable condition. It seems possible that previously unstable, but now rehabilitated and stable stream reaches might meet the conditions for an exempt stream reach. This might increase the number of exempt reaches overall.	Document text from previous lines 699-701 have been updated accordingly.
Julie Procopio	707	Include language that states that the methodologies presented are intended to guide Copermittees and facilitate calculation of water quality equivalence. Nothing should limit the Copermittees option to use alternative methods, provided that they are well-	Document text for Section 1.1 has been updated to clarify the standards set forth in this guidance must be adhered to unless a Copermittee gets an alternative WQE methodology approved by the RWQCB.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
		supported with scientific principles.	
Julie Procopio	708	Item 4 "Stream Rehabilitation" should state that control credits can be gained through "expansion of channel infiltration capacity" as well as removal of impervious surfaces.	Comment noted. At this time, mechanisms for stream rehabilitation projects to provide pollutant removal are limited to reductions in runoff volume achieved through the reduction of impervious surfaces only.
Helen Davies	711	Reference to "governing Copermittee." This should be defined or clarified.	Document text revised to read applicable Copermittee.
Helen Davies	720	Credit should be given for water quality improvements.	Table 1-2 and associated text has been revised for clarity. Stormwater pollutant control credits are available through volume reduction only.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Chris Crompton	832	Land use factors are used in an overly conservative manner in calculations. It is unclear why new land use pollutant data to be used must be extrapolated to an entire management area. Furthermore, it could be costly to use additional or higher quality data.	Prior comments from a number of parties suggested that not relating pollutant load to ACP performance would not be in conformance with the post-construction BMP elements of the permit. In order to develop an equivalency method that took into account relative performance of ACPs as compared to retention or biofiltration at PDPs on specific pollutants, without requiring the complex process of quantitative assessing pollutant specific removal processes for each application, the land use factor was developed. Because the permit explicitly requires that the ACP achieve a greater overall benefit to water quality, when comparing pollutant specific performance, the pollutant of concern in the watershed that the ACP has the poorest performance for, when compared to retention or biofiltration at a PDP would need to drive the sizing of the ACP in order for the ACP to be equivalent to retention or biofiltration at a PDP. Thus, this is not conservative, but necessary to show a greater overall benefit to water quality in a quantitative manner. The limiting pollutant needs to be that pollutant for which the ACP has the least amount of effectiveness when compared to retention or biofiltration at a PDP. The other pollutants would then be removed to a greater extent than retention or biofiltration at a PDP, this showing an overall greater benefit to water quality.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Chris Crompton	832	For independent ACPs to have the widest applicability in the WMA, the Land Use Factor (L) is limited to the minimum efficacy for all Pollutants of Concern (POC) in the WMA. Future matching PDP(s) may be developed in a hydrologic sub-unit where the limiting ACP Pollutant of Concern may not be a concern and a higher L value would be appropriate.	This will be determined based on an assessment of the impairments in the receiving water to which the ACP and PDPs are tributary, as described in the land use factor development subsection. With time, as PDP BMPs and ACPs are implemented, monitoring may show that the impairments change in the receiving waters, thus changing the land use factors to be used for future ACPs. Thus, through ongoing implementation of the regional monitoring programs, biennial reviews of the impairments per Section 303 of the Clean Water Act, and implementation of post-construction BMPs, one would expect to see built-in adaptive management in the alternative compliance program with future ACPs being developed based on different limiting pollutants as receiving waters are de-listed due to the improvements in water quality occurring through implementation of the post-construction BMP program.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Chris Crompton	947	Iterations of various tributary land use designations using the presented methodology in the South Orange County WMA leads to some results which do not appear to support pollution control intentions when determining Earned Pollution Control Value for independent ACPs: a. 24% efficacy reduction for ACPs with commercial use tributary areas everywhere except in Dana Point Harbor sub-unit which instead would be multiplied by 1.17. b. 60% - 76% reduction for ACPs with educational use tributary areas. c. 78% reduction for ACPs with transportation area tributaries. This methodology provides a significant disincentive for the creation of independent ACPs for areas with transportation and educational tributaries (desirable for agencies such as OCTA or school districts who are likely to have interest in banking credits). It also disproportionately treats independent ACP efficacy for commercial area tributaries between sub-units thereby encouraging inaccurate land use designations.	The land use factor is strictly based on relative differences in pollutant loads from land uses based on the available land use runoff concentration data. As these data sets are improved, the land use factors can be commensurately changed. The requirement for greater overall improvement to water quality has moved the WQE program toward this approach of assessing relative differences in pollutant loads with the land use factor. Projects on transportation systems where receiving waters are impaired only for bacteria are not likely to achieve greater overall water quality improvements unless the projects are sized to achieve bacteria load reductions equivalent to those that would be achieved through retention or biofiltration PDPs. Rather than requiring an applicant to assess and prove to an approving agency the specific pollutant load reduction that will occur with an ACP as compared to retention or biofiltration on PDPs, the land use factor has been developed as a general means of comparing pollutant load reduction differences and crediting the ACP appropriately based on those comparisons. While isolating the land use factor may suggest dis-incentives for ACPs collecting water from specific land uses, a number of other factors affect incentives for ACP projects: land cost and availability, conjunctive land uses, other community benefits, etc. It is necessary to focus on the specific impairments, the relative pollutant loads tributary to ACPs as compared to PDPs, and assign proportionally consistent credits that provide incentives for ACPs to be located and sized to reduce receiving water impairments.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Chris Crompton	962	As additional data is collected, the Guidance indicates that it may be used in these calculations under restrictions stated in Footnote 6, Page 21: "It is possible however, that individual Copermittees will allow the use of other data they believe to more appropriately quantify pollutant concentrations for the WQE pollutants of concern. In this case, they may elect to substitute other data provided that the following criteria are met: 1) It must be demonstrated that augmented data is in fact more appropriate for use, and 2) Pollutant concentration data must be applied consistently across an entire watershed management area including across jurisdictional boundaries." However, clarify why a particular dataset must be applied throughout a Watershed Management Area (WMA) and across jurisdictional boundaries. A dataset should be applicable to the representative monitored area, however large or small.	This is regarding the land use factor. The land use factor is the method developed for evaluating relative differences in pollutant loads between PDPs and ACPs. The Event Mean Concentration (EMC) values that have been established for different land uses are used for evaluating relative pollutant load differences between project locations. We recognize that the EMCs are subject to potential update based on availability of new data. The purpose of the footnote is to provide the ability for a Copermittee to improve the dataset and update the EMCs, should they have better data associated with land use pollutant loads. EMC updates would be throughout Region IX and not specific to a watershed or jurisdiction. Other changes to the methodology are not allowed without amending the WQE document for RWQCB approval. However, it should be allowable for updates to the EMC data-set without seeking RWQCB approval. We are not proposing that land use specific EMCs would vary by watershed or jurisdiction without amending the WQE document for RWQCB approval. The purpose of establishing a consistent land use factor basis across jurisdictional boundaries is to allow for trades to be trans-jurisdictional if Copermitees would seek such a program governance structure. The entire purpose of the land use factor is to ensure that each pollutant generated by the PDP for which the receiving water is impaired is being treated to at least the same extent by the ACP, which may have different pollutant loads to it from the tributary land uses. This will result in at least one pollutant treated to the same extent by the ACP with other pollutants treated to a greater extent by the ACP, which will result in an overall greater benefit to water quality, as

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	**Comment Response**
			required by the permit. It is not, in our opinion, overly conservative. In fact, the EMC differences between land uses were scaled to result in proportionally closer land use factors so that the differences would not be as significant the raw EMC data would create.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Helen Davies	1016	Why do we not prorate based on landuse to generate a combined runoff factor, rather than use the most conservative? We have several steps in this process where we select the most conservative option (such as selecting the lowest landuse factor). This results in us excessively oversizing the offsite mitigation required to comply with the permit which after all is supposed to result in "greater overall water quality benefit." Greater overall water quality benefit could mean siting BMPs in smarter locations where they can have greater benefit to the watershed, not excessively oversizing offsite mitigation areas because at each step we chose the most conservative approach.	Prior comments from a number of parties suggested that not relating pollutant load to ACP performance would not be in conformance with the post-construction BMP elements of the permit. In order to develop an equivalency method that took into account relative performance of ACPs as compared to retention or biofiltration at PDPs on specific pollutants, without requiring the complex process of quantitative assessing pollutant specific removal processes for each application, the land use factor was developed. Because the permit explicitly requires that the ACP achieve a greater overall benefit to water quality, when comparing pollutant specific performance, the pollutant of concern in the watershed that the ACP has the poorest performance for, when compared to retention or biofiltration at a PDP would need to drive the sizing of the ACP in order for the ACP to be equivalent to retention or biofiltration at a PDP. Thus, this is not conservative, but necessary to show a greater overall benefit to water quality in a quantitative manner. The limiting pollutant needs to be that pollutant for which the ACP has the least amount of effectiveness when compared to retention or biofiltration at a PDP. The other pollutants would then be removed to a greater extent than retention or biofiltration at a PDP, this showing an overall greater benefit to water quality.

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Julie Procopio	1025	I still believe that the average land use factor should be used, not the lowest land use factor. By using the average, alternative compliance will be more economically viable. If the BMPs are sized to be larger on average than needed, then we can ensure higher water quality benefit. The current method takes an approach that is inappropriately conservative and appears to go beyond what the Permit requires.	Prior comments from a number of parties suggested that not relating pollutant load to ACP performance would not be in conformance with the post-construction BMP elements of the permit. In order to develop an equivalency method that took into account relative performance of ACPs as compared to retention or biofiltration at PDPs on specific pollutants, without requiring the complex process of quantitative assessing pollutant specific removal processes for each application, the land use factor was developed. Because the permit explicitly requires that the ACP achieve a greater overall benefit to water quality, when comparing pollutant specific performance, the pollutant of concern in the watershed that the ACP has the poorest performance for, when compared to retention or biofiltration at a PDP would need to drive the sizing of the ACP in order for the ACP to be equivalent to retention or biofiltration at a PDP. Thus, this is not conservative, but necessary to show a greater overall benefit to water quality in a quantitative manner. The limiting pollutant needs to be that pollutant for which the ACP has the least amount of effectiveness when compared to retention or biofiltration at a PDP. The other pollutants would then be removed to a greater extent than retention or biofiltration at a PDP, this showing an overall greater benefit to water quality.

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Joanna Ogintz	1116	Pollutant removal efficiency for flow-thru BMPs (Section 2.3.1.3.1, page 29) – If removal efficiencies are not provided, how will consistent, technically-sound evaluations be provided? Will determination of removal efficiencies fall to each co-permittee individually?	The BMP Design Manual is the guidance for applicants seeking BMP approval with a designated removal efficiency. The BMP Design Manual, if adopted by a Copermittee, will be the guiding document for establishing the approval and potential removal efficiency for a flow-through or proprietary structural treatment control BMP within the jurisdiction of that Copermittee. The adoption of the BMP design manual and the processes specified therein for approval of flow-through or proprietary BMPs for implementation at PDPs when an applicant is seeking alternative compliance, does not imply that the Copermittee will approve the use of a flow-through or proprietary BMP as an alternative compliance project, per se. The Copermittee has discretion to approve, or not, any BMP as an alternative compliance project provided they establish the removal efficiency to be applied for that BMP and the basis for which that removal efficiency is to be demonstrated in the record and that the efficiency is not more than would be applied for the BMP when implemented at a PDP.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	**Comment Response**
Joanna Ogintz	1124	Evaluation protocols (Section 2.3.1.3.1, page 30) – Guidance manual should clarify what testing protocols are acceptable, and how results of those protocols will apply to pollutants of concern. For example, the General Use Level Designations from Washington Department of Ecology should be required to achieve approvals for the various pollutant removal categories. If phosphorus is a pollutant of concern, the Ecology GULD for Phosphorus Removal should be required. Similarly, if metals are the pollutant of concern, the Ecology GULD for Enhanced Removal should be required. If other protocols (such as New Jersey) are acceptable, they should be listed here.	The BMP Design Manual is the guidance for applicants seeking BMP approval with a designated removal efficiency. The BMP Design Manual, if adopted by a Copermittee, will be the guiding document for establishing the approval and potential removal efficiency for a flow-through or proprietary structural treatment control BMP within the jurisdiction of that Copermittee. The adoption of the BMP design manual and the processes specified therein for approval of flow-through or proprietary BMPs for implementation at PDPs when an applicant is seeking alternative compliance, does not imply that the Copermittee will approve the use of a flow-through or proprietary BMP as an alternative compliance project, per se. The Copermittee has discretion to approve, or not, any BMP as an alternative compliance project provided they establish the removal efficiency to be applied for that BMP and the basis for which that removal efficiency is to be demonstrated in the record and that the efficiency is not more than would be applied for the BMP when implemented at a PDP
Julie Procopio	1413	Stream Rehabilitation paragraph should be revised to include that quantifiable storm water pollutant control benefits can be achieved through expanding the channel infiltration capacity.	Comment noted. At this time, mechanisms for stream rehabilitation projects to provide pollutant removal are limited to reduction in stormwater runoff volumes through reduction in impervious surfaces only.
Helen Davies	1425	Why does it matter whether or not the development that is being taken off the table through land preservation would have triggered PDP requirements? It seems totally irrelevant and unnecessarily conservative.	If the potential development will trigger PDPs, it will need to retain and treat stormwater per the PDP requirements. Thus, preserving the land from development would not achieve a water quality or HMP benefit.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Helen Davies	1473	The last sentence of the example states that the extra credit cannot be banked for future use until a credit system has been developed. Does that mean that credits generated, but unused can be incorporated into a credit system if it is developed at a later date?	At this time, the WQE team's understanding is that ACPs may generate credits prior to the development of a credit system, but these credits may not be traded and/or sold until a credit system is developed.
Helen Davies	1528	The flow control facility could also be a City-implemented project. Correct?	Correct. A City-implemented project that is not tied to a specific development project would be considered an independent ACP.
Chris Crompton	1545	Section 3.2 explains the use of Directly Connected Impervious Area (DCIA) as the equivalency metric for determining impacts and benefits for hydromodification associated with a PDP or an ACP. However, the bulleted text should be clarified to explain why DCIA is a better metric than volume and flow control (lines 1363-1370)-it does not complete the comparison of DCIA v. volume/flow control. At lines 1371- 1376, some limitations of hydrologic models are discussed, but the relevant point is better and more clearly stated at lines 1383 -1384. In addition, the discussion of land use factors at lines 1377 - 1382 does not clearly conclude that DCIA is a better metric because land use factors are not used.	Document text updated accordingly.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Chris Crompton	1603	At line 1603, it states that semi-pervious areas within a PDP will be treated as impervious. Using this as an underlying assumption is too conservative, and provides no incentive to use semi impervious/semi-pervious materials. Semi-pervious surface infiltration rates and runoff coefficients can be determined for a PDP application, and some scenarios should allow+E77` appropriate consideration of these surfaces. Eventually a method to account for these surfaces will be developed. It should be recognized that all surfaces are actually semi-impervious or semi-pervious-it would be beneficial if these terms were defined.	Semi-pervious features were discussed in the April 15th TAC workshop. The consensus of the TAC was to consider semi-pervious features as impervious for a few reasons. It was discussed that semi-pervious features are only semi-pervious as long as they are maintained, but maintenance is not guaranteed (MS4 Permit only requires maintenance of structural BMPs). It was discussed that there is a big variation in semi-pervious surfaces, from surfaces that can intercept several inches of rainfall down to surfaces that have little to no interception but are not fully impervious so they are still called semi-pervious. Some projects have the semi-pervious surface receive only direct rainfall, while some have runoff directed to the semi-pervious surface from other areas. Some semi-pervious surfaces have liners under them. To address the variations, a set of rules must be established, which complicates the process and would require a study of how much benefit to the flow duration curve is actually provided. Finally, neglecting the potential storage and infiltration or evaporation provided by the semi-pervious surfaces advances the concept of the offsite control providing a greater benefit than onsite control (required by the MS4 Permit for alternative compliance program).
Helen Davies	1633	Insert the word "credits" prior to "to a PDP"	Text has been revised to reference Earned DCIA Effectively Managed (new terminology for the specific credit)

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Chris Crompton	1654	For PDPs which increase impervious area the ACPs must be in the same drainage system and located prior to system discharge to receiving water. These location restrictions and requirements severely limit ACP possibilities for hydromodification and reduce interest in creating independent ACPs.	Comment noted. The location restrictions are necessary to prevent a PDP from creating a new impact to a stream through the addition of new impervious area draining directly to the stream without mitigation. Without the location restrictions, PDPs increasing impervious area would have the potential to create a new impact to their respective receiving streams. However, redevelopment PDPs with NO increase in impervious area have more options for the ACP location. This may encourage redevelopment PDPs to maintain or reduce existing impervious area.
Helen Davies	1698	Replace the word "pending" with the word "if."	Document text updated accordingly.
Helen Davies	1717	Replace the word "pending" with the word "if."	Document text updated accordingly.
Chris Crompton	1814	The discussion of stream rehabilitation does not describe other relevant permitting such as Section 404 Dredge and Fill Permits (USACOE), Section 401 Water Quality Certifications (issued by the RWQCB), and habitat and species permitting (USFW and CDFW).	Permitting issues will be discussed in detail during the credit system program development. Since this document focuses on equivalency, permitting issues are not discussed here.
Julie Procopio	1884	The second sentence of section 3.d. should be revised to read, "Also for the development project to qualify for credits, the most sensitive stream segments from the project to the downstream exempt water body should be rehabilitated, subject to Copermittee approval." Making a project responsible for ALL sensitive segments makes incremental improvement to streams infeasible. Provided that a project addresses the most sensitive segments AND the mitigation results in overall improved water body health, the Permit requirement and goal has been met.	Incremental stream improvement must begin at the downstream end of the watershed and then continue upstream. If a project is use the stream rehabilitation credit, then all stream segments downstream of the project must be stabilized or be proven to be otherwise stable.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Chris Crompton	1954	Many of these examples demonstrate why there is concern over the use of EMCs from land use types to determine POC loading. Land uses are not homogeneous within a given area that has been lumped in a single land use, causing inherent inaccuracy in such designations. Runoff data used to develop the subject EMCs was not specifically developed for this purpose. The Guidance should provide Project Proponents and Permittees significant flexibility in determining the data used to determine POC loading, or provide possible alternative methods.	Use of the EMCs provided a way to consistently evaluate land use and pollutants of concern. As noted above, the EMC values that have been established for different land uses are used for evaluating relative pollutant load differences between project locations. We recognize that the EMCs are subject to potential update based on availability of new data. This guidance document provides for the ability for a Copermittee to improve the dataset and update the EMCs, should they have better data associated with land use pollutant loads. EMC updates would be throughout RWQCB Region 9 and not specific to a watershed or jurisdiction. Other changes to the methodology are not allowed without amending the WQE document for RWQCB approval. However, it should be allowable for updates to the EMC data-set without seeking RWQCB approval. We are not proposing that land use specific EMCs would vary by watershed or jurisdiction without amending the WQE document for RWQCB approval. The purpose of establishing a consistent land use factor basis across jurisdictional boundaries is to allow for trades to be trans-jurisdictional if Copermittee would seek such a program governance structure. Note also that the land use factor is based on a weighted average of land uses tributary to an ACP and PDP - thus, all and uses in the tributary subcatchment are taken into account.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Helen Davies	2066	We believe that selecting the lowest landuse factor (instead of using an average) is overly conservative.	Prior comments from a number of parties suggested that not relating pollutant load to ACP performance would not be in conformance with the post-construction BMP elements of the permit. In order to develop an equivalency method that took into account relative performance of ACPs as compared to retention or biofiltration at PDPs on specific pollutants, without requiring the complex process of quantitative assessing pollutant specific removal processes for each application, the land use factor was developed. Because the permit explicitly requires that the ACP achieve a greater overall benefit to water quality, when comparing pollutant specific performance, the pollutant of concern in the watershed that the ACP has the poorest performance for, when compared to retention or biofiltration at a PDP would need to drive the sizing of the ACP in order for the ACP to be equivalent to retention or biofiltration at a PDP. Thus, this is not conservative, but necessary to show a greater overall benefit to water quality in a quantitative manner. The limiting pollutant needs to be that pollutant for which the ACP has the least amount of effectiveness when compared to retention or biofiltration at a PDP. The other pollutants would then be removed to a greater extent than retention or biofiltration at a PDP, this showing an overall greater benefit to water quality.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Chris Crompton	2690	These examples need a detailed review, but overall add a lot of utility to the Guidance. However, regarding Section 4.4 (lines 2690-2698), a Land Restoration example-it seems there would be very little incentive for implementation of a project to restore 10 acres of existing development back to a predevelopment condition in perpetuity. A more realistic scenario would be helpful. At Step 2.3- lines 2979-2982: Land restoration Natural System Management Practices only consider runoff from non-PDP projects (assuming no BMPs)-however there are minimum BMP requirements for non-PDPs which might rate consideration.	Lines 2690-2698 represent Land Restoration and Lines 2979-2982 represent Land Preservation. These are two different NSMP examples for two different scenarios. For the Land Preservation scenario, only projects that would not trigger PDP requirements are considered. Otherwise all storm water management for the site would be part of PDP as opposed to alternative compliance. For the Land Restoration example, it is possible that an applicant would choose to restore land and this is only to provide an example of how that would be calculated. Incentives for either are likely to be based on more than water quality considerations. For example, while not in this region, the City of San Francisco is considering redeveloping an abandoned manufacturing facility adjacent to San Francisco Bay, currently a brownfield site, as a park and open space in perpetuity using funding from a range of sources. While they do not have an alternative compliance program in which they can derive some value from water quality credits, such additional sources of potential revenue may assist such projects with their completion.

Reviewer Name	Line #	Comment on *Public Draft #1 Dated 7/14/15*	Comment Response
Helen Davies	2780	We believe that selecting the lowest landuse factor (instead of using an average) is overly conservative.	Prior comments from a number of parties suggested that not relating pollutant load to ACP performance would not be in conformance with the post-construction BMP elements of the permit. In order to develop an equivalency method that took into account relative performance of ACPs as compared to retention or biofiltration at PDPs on specific pollutants, without requiring the complex process of quantitative assessing pollutant specific removal processes for each application, the land use factor was developed. Because the permit explicitly requires that the ACP achieve a greater overall benefit to water quality, when comparing pollutant specific performance, the pollutant of concern in the watershed that the ACP has the poorest performance for, when compared to retention or biofiltration at a PDP would need to drive the sizing of the ACP in order for the ACP to be equivalent to retention or biofiltration at a PDP. Thus, this is not conservative, but necessary to show a greater overall benefit to water quality in a quantitative manner. The limiting pollutant needs to be that pollutant for which the ACP has the least amount of effectiveness when compared to retention or biofiltration at a PDP. The other pollutants would then be removed to a greater extent than retention or biofiltration at a PDP, this showing an overall greater benefit to water quality.
Helen Davies	3126	Replace the word "filed" with the word "field."	Document text updated accordingly.
Helen Davies	3918	There is no mention of habitat restoration. This should be included.	Stream rehabilitation project specifics will be presented in more detail during the credit system development process. For this document, only hydromodification equivalency is presented for stream rehabilitation.

Reviewer Name	Line #	Comment on Substantial Completion Draft Dated 5/12/15	*Response*
Venkat Gummadi	275	Please note the scope of the BMP design manual was to develop design guidelines for implementing BMPs onsite. Design criteria will be different for some BMPs when they are implemented at a regional scale. And these are not addressed in the Model BMPDM.	Comment noted.
Scott Taylor	284	Revise "augmented" to "modified"	Comment Addressed - Text revised as suggested.
Scott Taylor	315	This last sentence in impenetrable.	Comment Addressed - Text revised for clarity.
Tory Walker	322	I don't see any discussion regarding the option of treating offsite runoff originating up gradient to the PDP; because it is usually better to not leave things up to interpretation, there should be an explicit discussion describing the scenario of treating these offsite flows within the context of the ACP. Currently, such runoff is typically taken through or around the site and is specifically excluded from treatment, but the ACP presents a real opportunity to efficiently and effectively improve water quality in these instances. As offsite flows from up gradient properties must be handled/conveyed through or around PDPs regardless, it just makes sense to include the option of treating that runoff for water quality through onsite BMPs, since the PDP must incorporate onsite BMPs for water quality anyway. While recognizing there will certainly be instances where a PDP project proponent would not want to exercise that option, I believe there would be far more instances where the option would be exercised because of the capital and O&M cost savings in achieving the ACP required treatment onsite vs. other AC options offsite. This is one application in particular where some flow-based BMPs can work rather effectively in removing pollutants and making a	Comment Addressed – Concept of onsite alternative compliance potential is now discussed in Section 1.3-General Concepts.

Reviewer Name	Line #	Comment on Substantial Completion Draft Dated 5/12/15	*Response*
		real impact on reducing pollutant loads.	
Christina Arias	434	Page 7 references Natural Systems. In this context Line 434 mentions that removal efficacies are not understood "as well as more engineered BMP solutions." Not sure if you meant solutions in the creek or upstream, but my first read was that it meant in the creek. I recommend striking that language, someone may interpret that as authorizing the placement of BMPs in the creek.	Comment Addressed - Text revised as suggested.
Scott Taylor	513	Revise 0.00 to 0 or zero.	Comment Addressed - Text revised as suggested.
Scott Taylor	713	Still don't like this and think area weighted land uses would be just as good environmentally, but if this is the group consensus - ok. The relationships between these values is not stationary, treating like it is builds in a false bias.	Comment Noted - The current methodology does allow for mitigation of in-kind land uses but when ACP/PDP land uses vary, consideration of EMCs is necessary.
Tory Walker	739	*Paraphrase of verbal comment* - Variations in Land Use Factors can greatly overshadow the effects of all other WQE variables, yet they're based on uncertain EMC values.	Comment Addressed – The effect of uncertain EMC values on WQE results has been reduced by normalizing EMC data prior to use. Additional information on normalization of the data is located in Appendix B.1.2.

Reviewer Name	Line #	Comment on Substantial Completion Draft Dated 5/12/15	*Response*
Helen Davies	755	*Excerpt* -...the method calls for the lowest land use factor to be selected when calculating loads removed and to verify compliance. As pointed out by others during the presentation, this is highly conservative resulting in the over-mitigating of pollutants except for those associated with the lowest landuse factor. As mentioned in the verbal response at the meeting, this will result in greater mitigation of pollutants and theoretically greater benefits to the watershed. However the benefits to the watershed will not be realized if the method used to calculate compliance is overly conservative and designers are dissuaded from using this system. We think that a more fair calculation should be used. We recommend that an average (mean) be used of the relevant land use factors instead so that compliance is achieved and is perceived to be more equitable	Comment Noted - Selection of the lowest land use factor is necessary to ensure that none of the identified WQE Pollutants of Concern for a particular watershed management area increase as a result of allowing offsite alternative compliance. While this is a conservative assumption that is built into the WQE methodology, please consider that mindful location of ACP projects may in some instances produce land use factors that are significantly greater than one; therefore, this assumption is not anticipated to significantly dissuade use of an offsite alternative compliance program.
Venkat Gummadi	820	Equation 2.5 appears to double count pollutant removal if the upstream BMP is a flow-thru BMP - [so over credits performance] For example, the first BMP is a flow thru that can provide a capture of 50% and remove 20% of the loads in the captured volume. Downstream is a retention basin that can also provide a capture of 50%. In this scenario Eq 2.5 = 0.5*0.2 + [(1-0.5*0.2)x(0.5*1)] =0.1+0.45=0.55. Whereas hypothetically speaking in this example the same 50% capture is treated by two BMPs. It flows through the first and gets retained in the second. Once it received flow thru, 20% of the loads are removed and then it goes to a retention basin with only 80%of the loads - the answer for this should be 0.5 -when the upstream BMP is flow-thru, concentration adjustments must be made. As written eq 2.5 will not give correct results for some scenarios.	Comment Noted - The scenario identified in the comment appears to omit the effects of the Provided Capture Factor on the flow-thru BMP.

Reviewer Name	Line #	Comment on Substantial Completion Draft Dated 5/12/15	*Response*
Scott Taylor	831	I disagree with this statement. Particularly when we are assuming the relationship between average water quality values remains constant. There is an NCHRP Tool (25-40) that does this well, given the influent concentration. Since we hold influent concentration static, the efficiency by BMP can be easily computed. See the spreadsheet tool that accompanies the NCHRP study	Comment Noted - Several TAC meetings were held in an effort to identify appropriate pollutant removal efficiencies for flow-thru BMPs. Due to variations in published data values, design parameters, and testing parameters, the TAC did not agree on default values. Section 2.3.1.1 Pollutant Removal Efficiency presents pathways for applicants to establish specific values.
Vaikko Allen	844	Excerpt - The current draft Water Quality Equivalency Guidance Document makes a very generous assumption regarding the performance of biofiltration BMPs by inferring a 66.6% removal for all pollutants. This assumption must be removed and replaced with a more defensible estimation of biofilter performance that is based on a literature review of field data collected for biofiltration systems. There are two readily available resources that can be used for this purpose. The first is the International BMP Database (www.bmpdatabase.org) which includes results from numerous bioretention studies. In 2014, a summary report was published that detailed BMP performance for a variety of conventional stormwater pollutants (Geosyntec et al. 2014). A second reference is an evaluation of biofiltration performance that was conducted by Roseen and Stone (2013) for the City of Seattle as part of an effort to understand how design criteria and media composition influence performance. As part of their research, they compiled site, design, and performance data for 80 field bioretention systems and 114 lab columns/mesocosms. Data from the International BMP Database were included in this pool as well as other research studies. Performance data were compiled as study summaries (e.g., study median influent, effluent, and removal efficiency).	Comment Noted - The intent of the Water Quality Equivalency Guidance Document is to demonstrate that implementation of an Alternative Compliance Project provides a greater overall water quality benefit than fully satisfying onsite water quality requirements. Therefore, when considering the pollutant removal efficiency for biofiltration elements, it is fundamentally important that the water quality equivalency guidance consistently apply such efficiencies to both PDPs and ACPs. The biofiltration pollutant removal efficiency of 66.6% has been established for use in the water quality equivalency guidance document based on biofiltration sizing criteria set forth in the Permit which states that biofiltration elements must be sized to biofilter 1.5 times the DCV. The Permit does not directly state that biofiltration elements provide an efficiency of 66.6% and the water quality equivalency guidance does not provide scientific data to support such a value; rather, this value is used solely within the context of water quality equivalency guidance to demonstrate that biofiltration of 1.5 times the DCV at 66.6% efficiency results in treatment that is equivalent to what would have been provided onsite by a PDP (1.50 x 0.666 = 1.00). Using a value lower than 66.6% for ACPs would hold ACPs to a higher standard than PDPs, which is counter to the intent of the water quality equivalency.

Reviewer Name	Line #	Comment on Substantial Completion Draft Dated 5/12/15	*Response*
Helen Davies	853	What is the source of the assumption that sizing a bioretention facility at 1.5 times the size necessary to treat the design capture volume, which result in 100 percent treatment? We realize it is in the permit, but it is unclear where this originated and what the scientific basis is for this. It is being relied upon to make some pretty significant decisions. We recommend that the technical basis for this assumption, including citations of relevant papers be included as a footnote to this assumption.	Comment Noted - R9-2013-001 Fact Sheets indicate that the 1.5 multiplier for biofiltration is based findings from the Ventura County Technical Guidance Manual which correlated reductions in annual runoff volumes provided by retention and biofiltration.
Tory Walker	866	Remove "and the RWQCB." I believe the RWQCB is looking to the Copermittees to take a more active role in determining which BMPs will be more effective for various pollutants and under various conditions; they do not want to be in the business of approving BMPs.	Comment Addressed - Reference to RWQCB approval of pollutant removal efficiencies has been removed.
Christina Arias	866	Pages 27-28 discuss flow thru BMPs and methodology being approved by the Copermittees and the RWQCB. Please strike reference to the RWQCB in this discussion. We do not plan on approving particular efficiency values or protocols. However we can assist with interpretation of permit language if there is a question on intent. (Lines 866, 879, 883)	Comment Addressed - Reference to RWQCB approval of pollutant removal efficiencies has been removed.
Venkat Gummadi	875	What was the source for listing FC as pollutant that tends to dissolve in stormwater? Currently, the plan is to adopt the table from Model SUSMP for the BMPDM, so this would be a deviation from that table.	Comment Addressed - Text has been revised to align with existing grouping of bacteria with "pollutants that tend to associate with fine particles" during treatment.
Scott Taylor	921	Re: 0.666 - Still can't see why we carry values to the thousandths place	Comment Noted - The value of 0.666 is used because 0.666 pollutant removal efficiency for 1.50 times the DCV equals 0.999 which can be rounded to a BMP factor of 1.00. While this is an artificially precise removal efficiency, it most directly reflects the text from the Permit.
Scott Taylor	1136	Revise wording of first sentence, explain how Land Use Factor was determined.	Comment Addressed - Text revised as suggested.

Reviewer Name	Line #	Comment on Substantial Completion Draft Dated 5/12/15	*Response*
Scott Taylor	1145	Say "until" rather than "unless". This leaves the door open to go back.	Comment Addressed - Text revised as suggested.
Helen Davies	1222	...the report states that credit will not be given for possible treatment of runoff from a directly connected impervious area (DCIA). If there is potential for the reduction of hydromodification impacts from the DCIA by going through a swale (as mentioned in the example), then credit should be allowed. We recommend that designers be allowed to take credit for onsite hydromodification reduction, such as draining runoff through BMPs.	Comment Noted - Credit for disconnecting impervious area (i.e., disconnecting downspouts or otherwise directing impervious area runoff across pervious areas not designed with structural storage and flow controls) was proposed and discussed during the February 24 TAC Subworkgroup meeting, and further evaluated by the consultant team following the meeting. Unfortunately, although impervious area disconnection and other site design BMPs described in the Model BMP Design Manual can be designed to provide some benefits to sizing pollutant control BMPs, it does not make an impact to reduce the flow duration curve for runoff from impervious areas for hydromodification management. Both volume and flow control are necessary to mitigate excess runoff for hydromodification control. When it can be demonstrated that there is onsite control provided by draining runoff through BMPs, the portion of the site with effective controls (demonstrated with flow frequency and duration curves) will not require offsite mitigation.
Scott Taylor	1223	Not sure if the word "shallow" is helpful. I would delete it.	Comment Noted - In context of line 1223, shallow is intended to imply a small volume of flow conveyed in something small (like a lawn swale) that does not have enough volume or area to attenuate peak flows or remove a significant portion of runoff by infiltration between the point of discharge from the impervious area and the point of collection in the urban drainage system.

Reviewer Name	Line #	Comment on Substantial Completion Draft Dated 5/12/15	*Response*
Helen Davies	1280	...the report states that hydromodification credit will not be given for the installation of certain semi-pervious features on a project. We do not think that this is reasonable and that some factor should be estimated (and if necessary refined with the availability of more data). We recommend that hydromodification credit should be allowed for all semi-pervious features.	Comment Noted - Semi-pervious features were discussed in the April 15th TAC workshop. The consensus of the TAC was to consider semi-pervious features as impervious for a few reasons. It was discussed that semi-pervious features are only semi-pervious as long as they are maintained, but maintenance is not guaranteed (MS4 Permit only requires maintenance of structural BMPs). It was discussed that there is a big variation in semi-pervious surfaces, from surfaces that can intercept several inches of rainfall down to surfaces that have little to no interception but are not fully impervious so they are still called semi-pervious. Some projects have the semi-pervious surface receive only direct rainfall, while some have runoff directed to the semi-pervious surface from other areas. Some semi-pervious surfaces have liners under them. To address the variations, a set of rules must be established, which complicates the process and would require a study of how much benefit to the flow duration curve is actually provided. Finally, neglecting the potential storage and infiltration or evaporation provided by the semi-pervious surfaces advances the concept of the offsite control providing a greater benefit than onsite control (required by the MS4 Permit for alternative compliance program).

Reviewer Name	Line #	Comment on Substantial Completion Draft Dated 5/12/15	*Response*
Helen Davies	1322	...the example is given of a discharge into an earthen channel and ensuring that the discharge at that outfall is protected from hydromodification impacts from a proposed development. As the speaker explained during the presentation, allowing an alternative compliance project on another outfall will not mitigate for impacts at the outfall accepting the discharges from the proposed development. This makes sense, unless the outfall is discharging into a concrete-lined channel. In that case, the hydromodification impacts could be addressed at any outfall along the length of the concrete-channel and have the same net result (as hydromodification impacts, if any, would be observed in downstream earthen portions of the channel). Please see the attached figure that shows a length of the concrete-lined portion of Escondido Creek and questions if there would be any difference between mitigating at one outfall versus another. We think that maximum flexibility should be allowed where there is no net impact to water quality and to facilitate alternative compliance projects to be used in these more densely developed areas. Note in densely developed areas, there may be few or no opportunities for offsite alternative compliance within a specific drainage area. We recommend that the options for alternative compliance projects to address hydromodification impacts be refined to allow a project to be situated upstream of any outfall to a concrete channel to which a development project drains.	The requirement is to provide mitigation prior to discharge to a susceptible receiving water. Since the concrete channel would not be considered a susceptible receiving water, mitigation within any of the storm drain systems discharging directly to the concrete channel would be acceptable because it would provide mitigation prior to the point that the concrete channel discharges to a susceptible system. In meetings we used the phrase "outfall-level mitigation." The word outfall was intended to mean discharge from a hardened system to a susceptible system rather than from a minor system to a major system. The document will be reviewed and text edits made where necessary to clarify this.
Scott Taylor	1415	Revise "lawns" and "Landscaped slopes" to pervious landscaping.	Comment Addressed - Text revised as suggested.
Scott Taylor	1472	Step 1 from the above list is not used here.	Comment Addressed - The calculation of the hydromodification control debit or credit is independent of the determination of receiving channel susceptibility to erosion in Step 1. The steps presented in Section 3.5.2 will be rearranged to address this comment.

Reviewer Name	Line #	Comment on Substantial Completion Draft Dated 5/12/15	*Response*
Scott Taylor	1530	Revise "Tributary" to "Tributaries" or are we saying watersheds here?	Comment Addressed – Text has been revised to remove this statement.
Scott Taylor	1874	Figure (possibly text?) does not seem to provide any value.	Comment Addressed – This figure has been removed from the document.
Venkat Gummadi	1893	Re: Non-PDP Development - Seems like a very liberal assumption.	Comment Addressed - Additional methodology for Land Preservation projects (i.e. regarding non-PDP development) are now provided in Section 2.
Venkat Gummadi	1919	10 acres example is not helping (makes sense if its very small area). It appears it's encouraging piecemealing to bypass the PDP requirements. This is not allowed by the MS4 permit and BMPDM.	Comment Addressed – Separate examples for Land Preservation and Land Restoration are now provided. In line with your comment, land preservation options will be limited to small (not hitting PDP thresholds).
Tory Walker	2248	*Paraphrase of verbal comment - Variations from BMPDM should be allows through alternative compliance.	Comment Noted - The guidance will remain silent on deviations from BMPDM. BMPDM Fact Sheets outline what guidelines are required and what guidelines have flexibility.
Venkat Gummadi	2479	Recommend rephrasing this sentence, as written it reads as if the WQIPs are flawed. Highest priority pollutant is typically the limiting pollutant and the strategies implemented to address this pollutant are anticipated to provide multi-benefit by also addressing other pollutants in the watershed management area. WQIPs went through a public process for selecting the highest priority condition for the respective watershed management area.	Comment Addressed - Text has been revised for clarity.
Venkat Gummadi	2519	Commercial FC EMC of 51,600 is from LA. Please double check shading	Comment Addressed - To align with WQIP tables, TP values for commercial education and industrial have been unshaded and FC value for commercial has been shaded.
Venkat Gummadi	2519	City led WMAs might have different LU concentration data from the LSPC models developed	Comment Noted - There is text allowing Copermittees flexibility in the EMC values they use; however, the values must be appropriately justified and implemented throughout an entire watershed.

Reviewer Name	Line #	Comment on Substantial Completion Draft Dated 5/12/15	*Response*
Venkat Gummadi	2666	FYI: Final BMPDM will only have the curves for Lake Wohlford for use in San Diego County. The differences observed between gages were minimal and do not appear to require the additional complexity. Lake Wohlford was selected because it generally provided the average results of the three gages.	Comment Addressed - For consistency with the BMPDM, Provided Capture Curves have been updated to simply reflect Lake Wohlford values.
Scott Taylor	2782	Do we have permission to reprint? Quality is iffy.	Comment Noted - Yes, permitted to print. Will rescan at higher resolution to improve quality.
Scott Taylor	3365	We should discuss the realities of right of way constraints here. Channel rehab will always be a compromise, this reads like there are no constraints on channel cross section and alignment, which will rarely be the case.	Comment Addressed - Text has been revised to include a sentence about potential constraints. Please note that this discussion is now located in Appendix C.2.5 of the guidance.

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